

CLEAN AIR

NATIONAL SOCIETY FOR CLEAN AIR
AND ENVIRONMENTAL PROTECTION

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**NATIONAL SOCIETY FOR CLEAN AIR
AND ENVIRONMENTAL PROTECTION**

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EDITORIAL

ENVIRONMENTAL POLICY — THE NEXT STEP

The *Environmental Protection Bill*, when enacted later this year, will make a welcome start to the task of upgrading the UK's pollution control legislation; in particular the long-delayed changes to the control of air pollution and the introduction of integrated pollution control will — so long as sufficient resources are made available — go some way to help rid us of our "dirty man of Europe" title.

However, this Bill is *only* a start. There is still much work to do to provide the kind of legislation necessary to deal with the urgent environmental problems facing the world today — pollution from transport, global warming, energy conservation and a co-ordinated approach to environmental policymaking all demand attention. The White Paper now being drafted by the Government will be seriously wanting unless it addresses such issues.

NSCA has written again to the Secretary of the State for the Environment seeking assurance that attention will be given to how national environmental policies can be effectively co-ordinated between Departments of State. The letter draws attention to the clear evidence of differences in approach between the Treasury and Ministries of Energy, Transport, Agriculture and Environment and, within the machinery of government, argues the need for an independent environmental protection commission charged to ensure the effective integration of national policy aims and oversee their effective implementation, including enforcement of environmental protection standards. While in response to our previous letter (see *Clean Air*, Autumn 1989), the Minister of State for the Environment replied that such a task fell within the remit of the Royal Commission on Environmental Pollution, we maintain our view that as presently constituted, it has neither the time nor the resources to take on such responsibilities. Moreover, because many of the current issues relate to non-pollution matters such as land use and resource use, the fact is that the RCEP's remit is insufficiently broad.

We trust too that the White Paper will encourage a debate on how to ensure that the true costs of the environmental impacts of all products, services and

activities are reflected in their current prices. In particular, the White Paper should review ways of ensuring that long-term effects, which tend to be poorly reflected are taken fully into consideration.

Finally, while the primary purpose of the White Paper will be to develop UK environmental policy, many of the solutions to today's problems can only be realised through international cooperation. The Government should therefore detail its international objectives, including our national role in achieving sustainable development.

NSCA 57th CONFERENCE - BRIGHTON
15 to 18 OCTOBER 1990
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ACID RAIN - THE NEXT STEPS
ENERGY AND THE ENVIRONMENT
ASSESSING THE ENVIRONMENT
NOISE
TOXICS AND NUISANCE
THE NEW POWERS FOR LOCAL AUTHORITIES

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16th AICB WORLD CONGRESS - 6 TO 8 JUNE 1990

International Association Against Noise

THE FUTURE FOR NOISE CONTROL: Towards an Interdisciplinary Approach

Regrettably, despite the excellent programme and widespread publicity internationally, this event has had to be cancelled due to the unacceptably low response. A list of those papers received is available from the Society on 0273 26313, priced at £2.00 each or £25.00 per set. Most are in English but a few are in German.

NSCA NEWS AND VIEWS

SALE OF UNAUTHORISED FUEL IN SMOKE CONTROL AREAS

The Department of Environment's 1986 consultation paper, *Air Pollution Control in Great Britain: Review and Proposals*, included a discussion of the problems caused by the sale of unauthorised fuel in smoke control areas. This pointed out that the *Clean Air Act 1968* forbids the sale of unauthorised fuel for delivery to a building in a smoke control area which does not have an exempted appliance. Coal merchants may deliver unauthorised fuel to houses in smoke control areas where exempted appliances are installed but must not deliver to houses without such appliances. But it is not an offence for "corner shops" and other retail outlets within smoke control areas to sell unauthorised fuel. Some local authorities consider that this undermines the control they can exert on the supply of fuel in smoke control areas (which goes some way to ensuring that smoke control is effective) and invites householders to use unauthorised fuel with non-exempted appliances. On the other hand, since coal may be burnt in exempted appliances, its sale in smoke control areas cannot be prohibited and it is difficult to envisage any legislative change other than a prohibition on sale which might be effective in curbing the sale of unauthorised fuel.

In commenting to Government NSCA said that it felt that the burning of unauthorised fuel in smoke control areas presents a continuing problem which from time to time reaches serious proportions. The main offenders are those on low incomes whose concern is to buy the cheapest available fuel irrespective of its calorific content and pollution potential. The problem stems from the widespread availability of unauthorised fuel — particularly bituminous coal — from corner shops, garage forecourts and, importantly, itinerant traders.

After considering the consultation document on the *Sale of Unauthorised Fuel in Smoke Control Areas*, the NSCA remains firmly of the opinion that the only solution likely to be both simple and effective is to impose a complete ban on sales of unauthorised fuels from all outlets within a smoke control area, other than from authorised retailers.

Of the other options examined, NSCA is of the opinion that a licensing system would prove to be complex and costly to implement and of dubious efficacy; and although we would welcome a statutory requirement for all bag sales to be labelled we accept that this would not, on its own, prevent abuse.

The simplest means of implementing a ban would be for it to cover all completed smoke control areas. Whilst there is certainly a potential "fringe" effect — where outlets

just outside smoke control areas would continue to sell unauthorised fuels — such an effect is inevitable under any measure short of a total national ban. However, it would also provide an incentive to local authorities to extend and complete smoke control programmes where there is a perceived problem with sales of unauthorised fuel.

The question of fairness to traders and consumers does not bear close scrutiny. Any traders who consider that coal sales form a significant part of their sales should in any case join the Approved Coal Merchants Scheme. Consumers can buy even small amounts of fuel from those operating the scheme. Furthermore, an individual's right to ease of supply is of less importance than the community's right to clean air.

In summary, therefore, we consider that an outright ban on sales of unauthorised fuels in smoke control areas represents the only truly fair and workable solution to this old and intractable problem. We urge that immediate steps should be taken to introduce the necessary measures.

TRANSPORTATION AND THE LOCAL ENVIRONMENT

The announcement, on the day before NSCA's 1990 Workshop, that Department of Transport plans for major road-building in London had been scrapped in favour of more environmentally-friendly policies, made the proceedings in Newcastle even more topical than we might have expected. It may also have explained why the DTp spokesman pulled out at the last minute; delegates speculated that a major re-evaluation of policy might be underway. Certainly the rest of the Workshop would have provided clear guidance to any DTp official charged with developing new policies to bring transport and the environment into a more harmonious relationship.

The opening session made it clear that present trends in traffic growth are simply unsustainable. Projected increases would cause mounting congestion, whilst even the introduction of catalytic convertors would provide just a brief fall in vehicle emissions during the 1990s before their effect was overwhelmed by the sheer increase in car

use. In an interesting aside delegates learned that, in reducing NO_x emissions, catalysts produce some ammonia — still of significance in the acid rain debate because critical loads are calculated on the basis of total nitrogen input.

Specialist papers covered air pollution monitoring by local authorities and air pollution from aviation (see this issue). Ultimately it was clear that new policies must discourage the use of private cars. This was approached in two ways. Firstly, there are a number of obstacles to the efficient use and development of public transport. Secondly, planning policies which physically deter cars, and fiscal policies which make cars more expensive to use, are necessary to encourage car users to seek alternatives. The concept of road pricing generated considerable discussion — it was felt that whilst it offered the potential to control congestion and raise revenue for improved transport systems, there was also the danger that it might simply displace congestion, be difficult to operate and hit the less well-off disproportionately.

As is usual with NSCA Workshops, the contribution from delegates was an important element, generating a high level of discussion and debate. Proceedings of the Workshop, which will provide a very useful overview of this important issue, will be available from NSCA within the next few months, price £16.

CONSTRUCTION AND USE REGULATIONS

The *Road Vehicles (Construction and Use) Regulations 1986* are to be amended to include a requirement to keep a vehicle's engine in tune and emission control equipment in working order. The Regulations will also be amended to implement various European Community measures on emission limits for petrol and diesel engined vehicles.

NSCA has broadly welcomed the proposed amendments and, in particular, the Department of Transport's further proposal that introduction of the "Luxembourg Stage I" standards for emission limits should be dropped because of the need to apply the much tighter Stage II limits agreed in June 1989. NSCA notes that the technology of emission controls is established worldwide and local tinkering or "own solutions" arising from a backward technology base only waste resources. This point is acutely relevant when European manufacturers have to respond to several different sets of emission control requirements according to their markets.

In its response to the Department of Transport consultation paper on the Regulations, NSCA also said that the requirement to maintain the emission standards of vehicles was only to be wel-

comed if it was to be enforced. There is a growing case for a simple emission test as part of the annual MoT test. Vehicles are lasting longer as body construction and protection has improved and are being driven further. Engines are increasingly stressed to give more power. Once engines begin to deteriorate mechanically, their emissions increase sharply, particularly in city/town centre driving.

The effect of the MoT test was to remove unsafe vehicles from the roads. By analogy, a simple emission test would remove polluting vehicles by requiring their engines to comply with their original specification. West Germany has shown that such a simple test indicates whether the engine is properly adjusted or in a suitable mechanical condition.

DIESEL OR PETROL?

Confusion surrounds the relative merits of using unleaded petrol or diesel fuel in light duty vehicles. Concerned motorists and, increasingly, fleet operators wanting to promote a "green" image, wish to use the most environmentally appropriate fuel. There is no outright "winner" — much depends on the criteria used for choice. Other alternatives such as liquified petroleum gas could also have a lower environmental impact. Other factors influencing choice might include pattern of vehicle use, forthcoming EEC requirements and control technologies, energy efficiency, air pollution and greenhouse gases, running and maintenance costs and refining issues — octane vs cetane, additives.

NSCA has commissioned a report which will aim to outline the relative environmental merits of diesel and unleaded petrol and to provide a checklist of factors which may be used in order

to make an informed choice about which fuel is best in any particular application.

The report, which it is hoped will be available in May, will be aimed at fleet operators, particularly local authorities but will also be of interest to individual motorists.

STRAW AND STUBBLE BURNING

Following Environment Minister, David Trippier's statement during the Committee stage of the *Environmental Protection Bill* that he considered that land on which commercial agriculture or horticulture is carried on would be covered by the meaning of 'trade premises' and would therefore be subject to the prohibition of emitting dark smoke". NSCA wrote to the Minister seeking confirmation.

In his reply David Heathcoat-Amory has said: "While it is for the courts to give any definite ruling on the matter, I am advised that if land is being used for commercial agriculture or horticulture, it constitutes trade premises for the purposes of Section 1 of the *Clean Air Act 1968*. Therefore, it would be an offence under Section 1, for example, to emit dark smoke from the burning of tyres on a commercial farm". NSCA's research shows that EHOs have rarely attempted to use Section 1 of the *Clean Air Act 1968* to control smoke from agricultural burning. Local authority legal departments have generally advised that farmland is unlikely to be considered as trade or industrial premises by magistrates. The Minister's statement could therefore give EHOs important new powers to control burning on agricultural land, which is a widespread problem.

On stubble burning, the new clause

proposed for the Bill basically provides powers for the Secretary of State (and those for Wales & Scotland) to ban, by order, the burning of crop residues, and powers to grant exemptions to this ban, and to make regulations controlling the burning of crops excluded from the ban. This is nothing like the ban which was promised following the disastrous burning season last year. The Minister could exclude virtually any crop, in any area he wishes. Farmers will make the case for exempting cereal straw in areas of heavy clay soil — precisely where some of the major nuisance arises.

NSCA believes that, where crop burning is a nuisance, farmers should be encouraged to change to alternative crops or alternative disposal methods rather than continue to burn. Some local authorities have argued that no burning at all should be allowed, and that difficult crop residues such as linseed should be disposed of to landfill. While NSCA accepts that there are certain, very rare cases where burning may be the only method of disposal, it will seek assurances that burning will only be allowed where no other disposal option is available.

NOISY NEIGHBOURS

That noisy neighbours are the most common source of noise annoyance and complaints in Britain today will come as a surprise to few people. NSCA's latest campaign report, published in March showed that

- complaints about noisy neighbours have risen "alarmingly" — in 1975 there were 6,325 complaints; by 1987/1988, the figure had risen to 59,132;
- the major noise problems were

amplified music and barking dogs;

- many local authorities fail to investigate complaints fully;
- there is considerable confusion about the law on noise.

Depending on where one lives in the UK, a complaint to the local authority about noisy neighbours may be fully investigated, receive minimal attention, or not be investigated at all. Such inconsistency of enforcement is clearly unacceptable says the report. NSCA believes that all local authorities should have a specific policy on neighbour noise, and make a commitment to devote adequate resources to the problem. Planning departments must ensure that noise control is "built in" to new proposals for

buildings.

The current confusion over noise law could be cleared up by legislation requiring local authorities to take "all reasonable steps" to investigate noise complaints from the public. The Society would like such a provision included in the "Green Bill". Legislation implementing a dog registration scheme could also be of help in controlling dog noise.

For existing legislation, higher fines are required to make people aware of the consequences of noise nuisance. NSCA also recommends the development of a good citizen's "code of practice" for noise guidelines on how to be a good neighbour.

DIVISIONAL NEWS

SCOTTISH DIVISION

On 7th February 1990 the Scottish Division held its first General Meeting in almost 10 years. The Division has been inactive since the early 1980s for a number of reasons but thanks to the efforts of a few Scottish members things are up and running again.

Worthy of a special mention for their efforts towards the rejuvenation in Scotland are Brian Kelly, Director of Environmental Health with Glasgow and District Council and Crawford Morgan, Pollution Controller with the same authority. Brian Kelly contacted John Langston early in 1989 expressing his concern with the lack of activity North of the Border and offered the ser-

vices of Crawford Morgan to act as temporary Honorary Secretary to try and generate interest in the Society. Their efforts have paid early dividends as the meeting on 7 February 1990 which was held in Glasgow's City Chambers was attended by around 90 representatives of local authorities, industry and universities.

A new enthusiastic Executive Committee was elected including Dr. Owen Harrop of the Centre for Environmental Management and Planning, Aberdeen University as President and Crawford Morgan confirmed as Honorary Secretary.

The meeting was addressed by John Langston, Secretary General and Frank

Shephard, Chairman of NSCA's Council, both of whom expressed their pleasure in seeing the Scottish Division operating again. Ian Wright, Chief Inspector of Her Majesty's Industrial Pollution Inspectorate also presented a paper on the forthcoming legislation which will revise air pollution control arrangements in Scotland. This was a lively, well attended meeting which attracted the interest of both local and national radio, TV and newspapers.

Since the meeting applications for membership from numerous organisations and individuals North of the Border have been received. The Society can now look forward to a greater contribution from Scottish members which will be most welcome.

NORTHERN IRELAND

An open meeting of the Northern Ireland Division, held on 9 August 1989 was addressed by NSCA Secretary General, John Langston, who gave a very concise report on the various activities carried out by the Society and the role it played both at National level and increasingly within the European context.

At the AGM of the Division held on 10 October at Belfast City Council offices Councillor Mrs. D. Dunlop, BA, was elected Chairman, Mr. G. McCurdy Honorary Secretary and Treasurer and a new Divisional Council, was also elected. During the coming year the Division is aiming to promote awareness

of the Society within Northern Ireland; increase membership particularly from outside the Local Authority forum and provide a one day seminar during 1990.

YORKSHIRE & HUMBERSIDE

The Chairman of the Society, Dr. F.E. Shephard, along with 21 members, attended a meeting of the Division held at the Houldsworth School of Applied Science, Leeds University on 17 January 1990. A Divisional Council meeting was held in the morning to discuss extensive divisional business, followed by a buffet lunch provided by the University.

In the afternoon the following presentations were made:

- Trends in dust deposition and acid rain chemistry in Leeds area from 1907 to the present. Dr. Andrew G. Clarke, Department of Fuel and Energy.
 - Diesel engine particulate emissions. Dr. Paul Williams, Department of Fuel and Energy.
 - In addition, a guided tour of the department's laboratories was made, which included the following areas of interest: monitoring of atmospheric particles and precipitation; diesel engine particulate emissions; other work of combustion generated pollution (gas turbines, spark ignition engines, fluidised bed combustion).
-

REPORTS

THE IMPACT OF AIRPORT OPERATIONS ON AIR QUALITY

by

Dr. D. W. Raper & Dr. J. W. S. Longhurst
Acid Rain Information Centre

This paper was presented at the NSCA's Spring Workshop held in Newcastle-upon-Tyne, 27th — 29th March 1990. A report of the Workshop appears later in this issue of *Clean Air*.

Introduction

A variety of current and prospective environmental pressures can be expected to act against the future development of airports and air traffic. The rising tide of European environmental concern will not avoid the issue. The public, whilst requiring the benefits of international travel will begin to demand that the air quality implications of airport operations are regulated. These demands may be expected to intensify as other sources of atmospheric pollution are regulated more stringently and to supplant the issue of noise as newer, quieter jets are introduced. In the UK the beginnings of such pressures are to be felt today in the concern over alleged "acid rain" implications of Gatwick Airport, development of a second runway at Gatwick and the on-going development of Stanstead. A recent opinion poll conducted by the authoritative MORI organisation (Enviro Technology, 1989) reveals that 60% of the sample population are very concerned about air pollution and 54% consider that air pollution near airports is either a major or a fairly big problem.

At the international level, environmental considerations are becoming increasingly important to airline operators as exemplified by the recent decision of the Swedish Government to impose an emission tax on nitrogen oxides (NO_x) and hydrocarbon (HC) emissions from internal flight operators (ICAO/CAEP/WGIII, 1988). Such pressures can confidently be expected to intensify and consequently it is essential that a proactive policy of air quality monitoring be undertaken to ensure that future operations of airports are not limited by unexpected environmental considerations.

The purpose of this paper is to review the impacts of airport operations on air quality, to assess the magnitude of the impact and to identify the major sources. A case study of Manchester airport is used to identify the issues of concern that are likely to affect airports and to exemplify proactive environmental decision making.

Emissions from Airport Sources

Emissions of pollutants from airports can be broken down into four main categories: aircraft operations, airside vehicle traffic, airport heating or power plant and landside vehicle traffic. Smaller source areas include fuel storage areas and engine test areas. Each of these sources has a pollution profile and contributes to the total airport pollutant emission.

i) aircraft operations: emissions arise from different modes of aircraft operation namely idle, taxi, take-off and approach and landing. Cruise operations are discounted for the purpose of this review. The mode of operation puts differing demands upon aircraft engines resulting in discrete pollutant emission patterns. HC and carbon monoxide (CO) emissions are most significant at low loads whereas NO_x emissions are at a maximum at periods of peak load (see Table 1). The international agreed standard landing and take off (LTO) cycle enables estimates of pollutant emission to be calculated. Typical emissions per LTO cycle are shown in Table 2 (Rolls Royce, 1990). Essential information for precise emission calculation includes the time intervals spent by each type of aircraft in each mode of operation, and appropriate emission factors for fuel type and aircraft.

ii) airside vehicle movements: airport authority vehicle movements will constitute a pollutant emission source. Data on engine mix, average speed, fuel type and consumption will enable emissions to be estimated for this source.

iii) heating/power plant: typically an airport has a heating plant and a power generating system, the latter either on stand-by or operating continuously to produce electricity for airport operations. Any heating/power facility operational at an airport will constitute a pollutant emission source. Typically fuels include gas or gas oil (diesel). Emissions can be calculated according to the type of installation and fuel. Diesel contains sulphur and emission of exhaust gases will constitute a point source of sulphur dioxide (SO₂) as well as NO_x, CO and HC.

iv) landside vehicle traffic: studies at Heathrow (Colwill et al, 1983; Atkins et al 1986), Stanstead (Williams et al, 1981) and Gatwick (Williams et al, 1980) indicate that landside vehicle traffic movements are a significant source of NO_x in the vicinity of an airport. Much of this traffic is undertaking journeys associated with airport operations, either carrying passengers or cargo. Air pollution emissions from this category must be seen as part of the overall airport contribution.

v) fuel storage areas: volatalisation of fuels will be a localised source of hydrocarbon emissions.

vi) engine test areas: engine test facilities will constitute a point source, with the relative importance of the emitted pollutants depending upon the load to which the engine is subjected.

Pollutants of Concern

There are many potential air pollutants emitted from airport sources but the most important are briefly reviewed in the following section. This review does not address

gases implicated in global warming although we acknowledge that airport emissions will contribute to this phenomenon.

Nitrogen oxides: many species of nitrogen oxides exist but of most importance to human health and the environment is nitrogen dioxide (NO_2). It is a reddish brown gas, very soluble in water and a strong oxidant. NO_x is emitted to the atmosphere during combustion either through oxidation of fuel nitrogen or atmospheric nitrogen. Usually the emission from aircraft is 90-95% nitric oxide (NO) by volume. The atmospheric chemistry of NO_x is complex but NO is rapidly oxidised to NO_2 by ozone (O_3), with the availability of O_3 limiting the reaction.

Hydrocarbons: a large group of organic molecules containing hydrogen and carbon. It includes methane but of most concern in air pollution is fuel derived benzene and toluene. Benzene, C_6H_6 , is a colourless clear liquid with a boiling point of 80.1°C . It is a fairly stable chemical but undergoes substitution and addition reactions. Typical urban concentrations range from $3 - 160 \mu\text{g m}^{-3}$. WHO (1987) estimate that exposure to a benzene concentration of $1 \mu\text{g m}^{-3}$ results in a lifetime leukaemia risk of 4 in 1 million. Toluene, C_7H_8 , is the most prevalent hydrocarbon in the troposphere. Chemically it is a volatile liquid with low solubility in water. Typical urban values may be $0.5 - 1000 \mu\text{g m}^{-3}$.

Carbon monoxide: a colourless, odourless, tasteless gas that is slightly lighter than air. It reacts with haemoglobin to form carboxyhaemoglobin; the affinity of haemoglobin for CO is 200 times higher than for oxygen. Mean 8 hour urban concentrations are generally of the order of 30 mg m^{-3} (WHO, 1987).

Other pollutants that are emitted from airport sources include sulphur dioxide and smoke. However, airport contributions are generally considered insignificant in comparison with urban areas. The above are primary air pollutants, many of them undergo complex atmospheric reaction leading to secondary pollutants, these include gases and aerosols, which may be removed from the atmosphere in a dry or wet form. Some of these secondary pollutants contribute to acid deposition. Concern over the acid deposition implications of airport operations has recently been expressed in the UK although Longhurst (1989) and Raper (1989a, b) failed to demonstrate any conclusive linkage.

Ozone is a secondary gaseous pollutant which is particularly important in the atmospheric chemistry of the polluted troposphere but as yet little data are available to characterise typical concentrations on and in the vicinity of airports.

Guidelines and regulations formulated for the protection of human health and the environment from nitrogen oxides, carbon monoxide and hydrocarbons are presented in Table 3.

Air Quality Measurements in the Vicinity of Airports

For the purpose of this paper a computer literature search using international databases (Enviroline, Environmental Bibliography, Pollution Abstract, Agricola and NTIS searched through DIALOG/IRS) has been undertaken. Whilst this has revealed some 1000 potentially relevant citations on the subject of airports, aircraft and air pollution,

many of them are elderly and it illustrates that in recent years air pollution arising from airport operations has not been a major research topic. This section briefly reviews the available literature.

Airports as a consequence of the various activities that take place there are a complex source of air pollution (Clark et al 1983a, b). Such pollution consists of many individual mobile and stationary point sources such as aircraft, service vehicles, motor vehicles, heating plant, fuel storage areas and engine test areas.

Air quality measurements have been undertaken at US airports since the 1950s, initially concentrating on the effect of emissions upon visibility (Naugle, 1980). However, the US interest in aviation and air quality has really been driven, either directly or indirectly, by the setting of Federal emission standards for civil aircraft and engines (see Federal Register, 1978). The first mention of aircraft in the regulatory process is made in the 1967 *US Air Quality Act*, with the 1970 *Clean Air Act Amendments* directing the Environmental Protection Agency (EPA) to set aircraft and engine emission standards if such emissions are judged to cause or contribute to air pollution which endangers public health. From this date a large number of air quality studies have been commissioned, some such as those investigating the emissions from Concorde have been carried out to ascertain specific information about changes to local air quality made by one type of aircraft (Segal, 1977; 1978). Others have investigated the emissions of trace elements from aircraft (Fordyce & Sheibley, 1975). More commonly studies have been undertaken to assess the local or regional impact of airport operations. In Europe air quality studies have also been undertaken with the first UK study at Heathrow being carried out in 1970 (Parker, 1971a, b). However, in the absence of the equivalent of Federal standards which require measurement programmes UK studies have generally been undertaken to gain data to support a planning application. For example, BAA commissioned studies to support development proposals at Gatwick (Williams et al 1980) and Stanstead (Williams et al, 1981). Other studies have been predictive, for example at Manchester (Williams, 1980) to assess the impact of runway extensions on local air quality.

Bastress (1973) identified hydrocarbons (HC), oxides of nitrogen (NO_x) and carbon monoxide (CO) as the major pollutants released from airport operations. Today these remain the major pollutants of concern. In general, assessments of airport emissions suggest that airports and aircraft are a relatively small contributor to regional air pollution (eg Bastress, 1973; Naugle & Fox, 1981; Clarke et al, 1983a, b) although local hotspots have been identified (Atkins et al 1986). Certain studies have addressed the health implications of specific emission sources (McMannon et al, 1980). Others have attempted to identify the ambient concentration of hydrocarbons and halocarbons at airports (Tsani-Bazaca et al, 1982); many of the hydrocarbon species are suspected carcinogens.

Studies in the UK at Gatwick (Clark et al, 1983, Williams et al, 1980), Stanstead (Williams et al, 1981), Ringway (Parker, 1974), Manchester International (Williams, 1980), Heathrow (Nichols et al, 1981; Atkins et al, 1986) and by Keddie et al (1973) have generally concluded that aircraft pollutant emissions contribute a relatively small

amount on a regional scale to pollutant levels and that concentrations do not significantly differ from other areas within the urban environment. Such studies have invariably drawn attention to the importance of landside vehicle movements to measured air pollutant concentrations.

Within the USA aircraft emissions are thought to contribute some 1% of national emissions of HC, NO_x and CO (USEPA, 1971) and aircraft HC emissions rank as the 11th largest source category in the USA (USEPA, 1977, Naugle & Fox, 1981). However the regional and local contribution to emissions can be much higher. Cirillo et al (1975) estimated a 3% contribution to regional background concentration, and Naugle and Fox (1981) quote EPA figures for Atlanta to show a similar regional contribution but a very significant local contribution (see Table 4). We estimate that aircraft operations at Manchester Airport contribute 0.4 — 0.5% of carbon monoxide emissions, 0.59 — 0.78% of hydrocarbon emissions and 0.45 — 0.68% of nitrogen oxide emissions in the Greater Manchester conurbation. The modelling approach to air quality has particularly found favour in the United States (Segal & Yamartino, 1981; Segal, 1988a, b; Segal & Hamilton, 1988). Yamartino et al (1980) have reviewed the impact of CO, HC and NO_x emissions in the vicinity airports and present monitoring data and modelling studies from Washington National, Los Angeles International, Dulles International, Lakeland, Florida, John F. Kennedy and Chicago O'Hare airports. Smith et al (1979) have presented the results of validation studies of air quality models applied to Dulles International. The output from models has often been used as inputs to policy alternatives, for example the impact of alternative airport policies upon the environment has been evaluated by Fromme (1977).

Jordan and Broderick (1978) reviewed the impact of nitrogen oxide emissions from aircraft. Modelling studies consistently predict very high levels of NO_x at points on the airport as a result of aircraft NO_x emissions. These high concentrations are localised and diminish rapidly at small distances downwind of emission. Most NO_x is emitted as NO and where conditions favour rapid conversion to NO₂ such as a smoggy summer day very high concentrations of NO₂ will occur at localised spots on the airport, these findings are confirmed by Atkins et al (1986) at Heathrow. The pattern of NO_x observed by Atkins et al (1986) is consistent with motor vehicles being the dominant source, with aircraft and stationary sources being of lesser importance. Jordan and Broderick (1978) conclude that unless emissions increase in the future there is not likely to be a violation of World Health Organisation standards by aircraft **alone** at major US international airports.

Aircraft emission standards were introduced in the USA in 1973 and their effect has been reviewed by Naugle (1981) and Cirillo et al (1976) have reviewed the pollution control technologies and other measures to abate aircraft emissions. Whilst the main application of emission standards has been civilian aviation the military has also been subject to the regulatory process. Air quality procedures at military air bases in the USA are described by Eberle and Steer (1982) and Naugle et al (1978) described the impact of aircraft emissions at ten US air force bases.

In the USSR Smelyanskaya et al (1985) have evaluated the emission of pollutants from civilian traffic at two Kiev airports. They calculate that between 60 and 70% of

emissions are produced during take offs and landings. At the larger of the two airports where 80% of air traffic was accounted for by Tu-154 and Tu-134 airliners the annual emission of CO, HC and NO_x was calculated as 520, 135 and 150 tonnes respectively.

Sawada and Nishi (1974) examined the dispersion of air pollutants from aircraft in the vicinity of airports in Japan. Lahmann and Prescher (1979) report on an extensive monitoring programme at Tempelhof — Berlin Airport, Federal Republic of Germany. Continuous automatic measurements were taken at the end of the entry strip of the airport, supplying 30 minute average concentrations of SO₂, CO, HC and NO₂. Compared to air quality data from the surrounding region and to air quality standards the measured values are acceptable.

In Sweden studies of air pollutant emissions from airports have been conducted at Arlanda, Stockholm and Landvetter, Gothenburg using differential optical absorption spectrometry (DOAS) equipment (Enviro Technology, 1989, per. com). Pollutants measured include benzene as a reference HC, CO and NO_x. Results from these studies are understood to be consistent with earlier work. Swedish experience is particularly interesting as the Government's 1987 Action Plan Against Air Pollution and Acidification recommends a 30% reduction in NO_x emissions between 1980 and 1995 and specifies the need to reduce aircraft emissions as part of a package of abatement measures. The plan acknowledges that aircraft emissions cannot be reduced by existing control technologies and thus measures to reduce the volume of traffic will be required (Aniansson, 1988). Sweden and the Federal Republic of Germany, driven by concerns over the impact of acid deposition are pressing ICAO for tougher aircraft emission standards, particularly nitrogen oxides. Sweden is understood to be progressing with the introduction of environmental taxes on fossil fuels; in the case of aviation the tax is likely to be used to limit the emission of nitrogen oxides.

Studies conducted in France (Delsey 1979, Viellard 1989) broadly confirm the findings of those carried out in other nations. Viellard (1989) demonstrates the low impact of airport emissions on air quality, particularly regarding Orly and Charles de Gaulle Airports. Schurter (1988) describes the legislation on air pollutant emission legislation in Switzerland and calculates the NO_x and HC emissions from Zurich airport according to the ICAO LTO cycle. This is then projected forward to future years with anticipated changes in aircraft type and engines built in to the calculation. Schurter (1988) reports that whilst significant reductions (perhaps 25%) in HC emissions may be expected through the use of modern power optimised engines with high combustion temperatures and compression this gain will be at the expense of NO_x emissions which may increase by 30% by 2000.

A report to the ICAO/CAEP/WGIII meeting in Boston (1988) summarised a range of studies undertaken in the Federal Republic of Germany, Austria, the UK, the USSR, Japan, Switzerland and the USA between 1966 and 1986. The general conclusion drawn from this review is that the data presented indicate that measurements of CO, HC and NO_x within an airport perimeter can, in part, be attributed to emission sources within the airport. However, on a wider regional scale emissions from an airport and from air traffic to/from that airport are small in comparison to sources in

urban/industrial areas surrounding an airport. Investigations concerning the effect of airport air pollutant emissions are also reported (ICAO/CAEP/WGIII, 1988). In addition studies in the vicinity of airports in the Federal Republic of Germany, Switzerland and the USSR indicate no adverse effects upon plants or micro-organisms.

Recently international environmental pressure groups, such as the influential Swedish Non Governmental Organisations Secretariat on Acid Rain, have begun to campaign for reductions in aircraft emissions of nitrogen oxides (Elvingsun, 1989). This is an activity that we confidently predict will intensify in the next few years.

Manchester Airport: A Case Study

Manchester Airport Plc have responded to heightened public concern over aviation derived emissions of air pollutants by commissioning an air pollution monitoring programme (Longhurst, 1989; Longhurst & Thomas, 1989; Longhurst and Raper 1990). This case study summarises the need for such a programme and identifies the main objectives of the programme.

Manchester Airport is a dynamic and thriving enterprise with significant levels of growth projected for the period to 2000. Air traffic is expected to increase significantly from 150,735 aircraft movements in 1989 to 329,000 by the turn of the century. The importance of the airport as a regional source area for air pollutants grows disproportionately as emission controls are introduced upon other sources, eg large combustion plant greater than 50MWth and motor vehicles, as a consequence of the implementation of European Commission Directives.

Air pollution emissions at Manchester Airport have been the subject of two short studies conducted by Warren Spring Laboratory (Parker, 1974, Williams 1980) to identify changes in air pollution concentrations as a result of development proposals. Whilst the utility of these works is limited they do provide a yardstick against which air quality can be compared in both absolute terms and pro rata by passenger or by air traffic movement. Williams (1980) emission estimates are given in Table 5. An order of magnitude for current emissions from airport sources can be estimated if one makes the large assumption that there has been no significant change in both the emission characteristics of commercial airline engines or the average carrying capacity of airliners serving Manchester between 1980 and 1989. A pro rata emission per aircraft and passenger can be used to estimate the 1989 emission of primary pollutants. In 1980, 83,281 aircraft movements and 4,427,083 passenger movements were recorded at Manchester; 1989 estimates are 150,735 aircraft and 10,250,000 passenger movements. Estimated emissions from aircraft are shown in Table 6. However, neither assumption underpinning the estimate can be fully justified but the resultant estimates do give an order of magnitude for current emissions of primary pollutants. Calculated pro rata with passengers carried the emission estimate is 22% greater than if calculated pro rata with aircraft movements. Neither estimate includes data on airside/landside vehicle emissions or heating plant emissions. In comparison to both regional and national emissions from ground based sources aircraft emissions are relatively small.

Landside traffic movements represent possibly the largest emission source at airports. In July 1988 Greater Manchester Transport Unit monitored traffic flows at Out-

wood Lane and Ringway Road, the two access points to the Manchester airport complex. The data showed two way 1988 annual average daily traffic (AADT) flows to be 46,500 vehicles, with the daily traffic composition being 94% cars, 3% buses and 3% other goods vehicles (GMTU pers. comm.). No traffic counts have been undertaken at the airport cargo centre where the majority of heavy goods vehicle flows are to be found. An AADT forecast for the Outwood Lane/Ringway Road area predicts 108,500 vehicles by 2001. By application of appropriate emission factors at a representative speed for this road, emissions of NO_x, (2.7g per km⁻¹), CO, (22 g km⁻¹) and HCs, (4.1 g km⁻¹) (Eggleston, 1987) can be calculated. Application of this crude technique suggests vehicle traffic on Outwood Lane/Ringway Road emits 1120 tonnes of CO, 209 tonnes of HCs and 138 tonnes of NO_x per annum. Traffic counts on all roads to the airport are required to give a fuller estimate of vehicle emissions. A finer resolution of vehicle class and speed is needed to provide precision in the estimates.

Manchester Airport has a heating system powered by gas oil (diesel) and the emissions can be calculated according to the type of installation and fuel. As diesel contains sulphur its exhaust gases will contain SO₂ as well as NO_x, CO and HC. This is not considered to be a major emission source in comparison to regional emissions. Plans are well advanced for a new combined heat and power station to be built at the airport. This will be fuelled by natural gas which will be used to power two turbo-diesels.

Emission of pollutants from the airport complex has periodically been a concern of local residents but the volume of complaints has been orders of magnitude less than for noise. When complaints have been investigated the airport, and aircraft movements in particular, have invariably not been the real cause of complaint except in isolated cases of odour. Recently concern has been expressed in the UK at a possible link between aircraft emissions and acid rain. In an investigation of the impact of Manchester Airport, Longhurst (1989) concluded that on the basis of data from one site of the acid deposition monitoring network (Lee et al 1988; Lee and Longhurst, 1989), not optimised to identify source specific effects, a local impact upon acid deposition could neither be identified nor the possibility of its occurrence rejected. Sulphur dioxide and nitrogen dioxide concentrations from monitoring networks, again not optimised for site specific source attribution, did not appear to show a local perturbation as a consequence of airport activities. A more rigorous statistical analysis of the data by Raper (1989a, b) failed to find a relationship between Manchester Airport and either elevated nitrogen oxide concentrations or enhanced acid deposition rates. Raper (1989a, b) concluded that an optimised air pollution monitoring programme is required at Manchester Airport and recommended a continuous monitoring system using differential spectroscopy in preference to discrete monitors (Raper, 1989c).

Clearly there is a need for reliable, quality assured data on emissions of air pollutants from aviation and related operations in the Greater Manchester conurbation. Manchester Airport Plc have recognised this need in commissioning a continuous monitoring programme. The objectives of the monitoring programme are to determine the emission of primary pollutants from Manchester Airport sources and to establish a monitoring system to determine the ambient concentration/deposition of primary and secondary pollutants on the airport site.

The programme of work will include studies to assess and quantify the relative importance of Manchester Airport as an emission source within the Greater Manchester region and the UK. Results of these studies will enable inputs to the decision making process, for example in predicting future emission scenarios based upon anticipated growth in aircraft and vehicle traffic rates. Such inputs will minimise the investment risk associated with environmental uncertainty.

Acquisition and effective utilisation of continuous air pollution data will allow proactive, environmentally responsible decision making to be implemented which is to the benefit of Manchester Airport Plc and the environment of the Greater Manchester public.

Conclusions

Airports are a highly visible part of the urban environment. Society clearly wishes to have the benefit of national and international air travel but equally society is now demanding the very highest levels of environmental protection. Such environmental concern is not a temporary, ephemeral issue, to be blown away on the next strong wind of economic recession. It is an articulation of a new set of deeply held values and beliefs that is here to stay. The proactive in industry will benefit by adjusting their activities to this new environmental imperative.

The aviation industry will not escape the tightening regulatory process that will be driven by this new awareness. Already two distinct pressures can be identified which will act together to ensure that stricter regulations are enforced in the future. Firstly, a number of European Community measures are beginning to reduce the contribution of power stations and motor vehicles to nitrogen oxide concentrations. Tighter controls on nitrogen oxides and the introduction of hydrocarbon controls are already being discussed by the European Community. The effect of these measures will be to enlarge the percentage contribution of aviation industry sources at a time when demand for air travel is expected to increase thus requiring more air movements and greater flows of traffic to and from airports.

The second identifiable pressure is the realisation of the magnitude of emission reductions that are required if polluted environmental systems are to be allowed to recover. This realisation is emerging from the scientific study of critical loads and levels. Essentially, the theory of criticality enables identification of the amount of pollution a sensitive system is able to receive without undergoing adverse change. Application of criticality theory to European emissions of nitrogen oxide suggests that reductions of at least 75% are required if sensitive systems are to be protected and those already affected allowed to begin to recover. Critical loads and levels theory is being translated into the regulatory environment, particularly via the United Nations Economic Commission for Europe. I suspect that critical load/level reductions will either be applied as specific percentage reductions to individual sources or via some blanket, area coverage as in the bubble approach. In the latter case all sources within a given area will be expected to contribute some emission reductions. Either way aviation will not avoid stricter regulation of its emissions.

Now is the time to begin to obtain ambient air pollution data, on a continuous basis, from specific, quality assured programmes of monitoring. Without this data to support arguments for equitable shares in future wide ranging emission reduction discussions, the industry may find itself severely disadvantaged.

Stricter regulation will be driven by a concerned, articulate and environmentally aware electorate; the rule setters when faced on the one hand by a green public and on the other by a perceived environmental polluter can no longer be expected to favour the polluter over the polluted.

Table 1: Emissions from gas turbine aero engines
Aircraft Operation

	Engine Power %	CO	HC gkg ⁻¹ fuel	NO ₂
Idle	5	5	20	5
Approach	30	5	2	10
Cruise	60	0	0	20
Take off	100	0	0	40

Source: Clarke, 1986

Table 2: Typical Emissions per LTO Cycle

Aircraft/Engine	Emissions per LTO cycle			Comment
	CO	HC	NO _x	
747 with four RB211—524 engines	20.0	3.7	68.0	Modern low emission engines
Fokker F100 with two Tay engines	14.0	1.4	5.8	
747 with four engines	80.0	36.0	58.0	Typical average fleet emissions
DC-9 or 737 with two engines	18.0	5.6	8.0	

Source: Rolls Royce (1990) pers. comm.

Table 3: Guidelines and Regulations for the Protection of Human Health and the Environment

NITROGEN OXIDES (as NO ₂)	
Human Health	
European Community	
Reference Period	Limit Value
Year (98 percentile of daily mean values)	200 µg m ⁻³
	Guide Value
Year (50 percentile)	50 µg m ⁻³
Year (98 percentile)	135 µg m ⁻³
World Health Organisation	
1 hour exposure guideline	400 µg m ⁻³
24 hour exposure guideline	150 µg m ⁻³
US Federal Ambient Air Quality Standard	
Year (arithmetic mean)	100 µg m ⁻³
Environmental Protection	
European Community	
Reference period	Guide Value
Year (50 percentile)	50 µg m ⁻³
Year (98 percentile)	135 µg m ⁻³
United Nations Economic Commission for Europe	
Critical Level	
Estimated at less than 30 µg m ⁻³	
Critical Load	
Estimated at 5 — 20 Kg N Ha ⁻¹ y ⁻¹	
CARBON MONOXIDE	
Human Health	
World Health Organisation	
15 minutes exposure guideline	100 µg m ⁻³
1 hour exposure guideline	30 mg m ⁻³
8 hour exposure guideline	10 mg m ⁻³

US Federal Ambient Air Quality Standard

1 hour	40 mg m ⁻³
8 hour	10 mg m ⁻³

HYDROCARBONS

Human Health

BENZENE

World Health Organisation

WHO is unable to recommend a safe level of airborne benzene. Benzene is carcinogenic with no known safe threshold.

TOLUENE

World Health Organisation

24 hour exposure guideline	7.5 mg m ⁻³
For the avoidance of odour	1 mg m ⁻³

Sources:WHO (1987)
Stern, A. (Ed.) (1986)
Stern, A. et al (1984)
European Community (1985)

Table 4: National, Regional and Local Contributions of Aircraft Pollutant Emissions

USA (National)			
Source	HC	NOx	CO
All aircraft	1.2%	0.6%	0.6%
Commercial	0.3%	0.4%	0.2%
Military	0.7%	0.2%	0.2%
General	0.2%	—	0.2%
All sources	30MT/y	22MT/y	116MT/y
Regional (Atlanta area)			
Source	HC	NOx	CO
Aircraft	3.2%	3.1%	2.4%
Fuel evaporation	0.8%	—	—
All sources	89kT/y	75kT/y	300kT/y
Local (Atlanta airport)			
Source	HC	NOx	CO
Aircraft	69%	75%	58%
Fuel evaporation	11%	—	—
Traffic/other	20%	22%	42%
All sources	3.9kT/y	2.9kT/y	9.5kT/y

Source: Naugle and Fox, 1981.

Table 5: Air Pollutant Emissions from Manchester International Airport (1980)

Source	Emission in tonnes per day			
	CO	HC	NO ₂	Smoke
Aircraft: Taxi/Idle	1.44	0.96	0.05	0.02
Take-Off	0.02	0.01	0.40	0.02
Approach	0.08	0.01	0.05	0.02
Total Aircraft	1.54	0.98	0.50	0.06
Airside Vehicles	0.42	0.03	0.04	0.04
Heating Plant	0.01	0.01	0.03	0.01
Airport Total	1.97	1.01	0.57	0.11

Source: Williams, 1980.

Table 6: Estimated 1989 Aircraft Emissions from Manchester Airport

Source		Emission tonnes per day		
		CO	HC	NO ₂
All Aircraft	1	2.78	1.77	0.90
	2	3.57	2.27	1.15
Annual Range		1015—	646—	329—
		1303	829	420
Percentage of Conurbation Emission*		0.42—	0.59—	0.45—
		0.54	0.78	0.68

1. Based upon a pro rata emission per aircraft movement and assuming no significant change in pollutant emission characteristics.

2. Based upon a pro rata emission per passenger and assuming no significant change in the average carrying capacity of airliners serving Manchester Airport.

* Emission calculated pro rata from national figures.

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HAZARDOUS DEVELOPMENTS AND BLIGHT

Keynote Address to Hazardous Development Seminar held in London on 11 December 1989, organised by Association of County Councils, Association of District Councils and Association of Metropolitan Authorities.

by
Barry Manifold*

Introduction

This subject of hazardous development is concerned with those industries which impose a threat on the local community due to the risk of an explosion, or release of toxic gas or some other major accident on the site. It is concerned with the need for safety measures to be taken around the hazardous site and the effects that these have on the existing community. It is concerned about making a choice between safety or stagnation.

This subject principally involves two different types of regulatory organisation:

- (a) On the one hand the Local Planning Authority has a duty to provide a balanced development plan in accordance with local needs and land use policies;
- (b) On the other hand the Health and Safety Executive is required to safeguard the health, safety and welfare of workers and members of the public.

The Health and Safety Executive (HSE) provides an advisory service to local planning authorities on hazards and, when asked, will make recommendations on individual planning applications. The local planning authority must decide on balance and, after due consideration of *all* the issues, whether to approve or refuse the proposed development on its individual merits.

If the resultant planning decision is to approve the development despite recommendations to the contrary by the HSE then more people will be exposed to an unacceptable risk. However, if the planning decision is to refuse the development, then the opportunity to provide an otherwise appropriate land use of that nature will be lost and the site will be blighted.

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Cheshire is currently facing problems in a number of locations principally in town centres and urban areas; where large numbers of people remain exposed to unacceptable levels of risk; where certain types of development are not recommended in strategic and extensive areas; and where district councils and the County Council are unable to formulate adequate long-term plans. There is no recognised solution available to this problem.

With around 1,700 hazardous developments in the United Kingdom affecting over 2,000 square kilometres of land and with around 600 planning applications being referred each year to the Major Hazards Assessment Unit it is likely that similar problems of blight will be experienced elsewhere in the country.

Legislation

Following the accident at Flixborough in 1974 the Government set up the Advisory Committee on Major Hazards. The recommendations of the Committee and action taken by the UK Government and the European Community following the Seveso incident, subsequently lead to the introduction of a range of legal measures which were intended

- (a) to identify the types and location of hazardous sites;
- (b) to reduce the risks associated with the hazardous site;
- (c) to mitigate the effects of a serious accident by land use planning controls and emergency planning measures.

In this context hazardous developments are considered to be those sites or pipelines which fall within the scope and procedures of the *Notification of Installations Handling Hazardous Substances Regulations 1982* and the *Control of Industrial Major Accident Hazard Regulations* introduced in 1984.

The HSE will require the operator of a site to take all reasonable steps to minimise the level of risk at source. Thereafter, in accordance with the recommendation of the Advisory Committee on Major Hazards the remaining level of risk is expected to be taken into account in the local planning process. By seeking to influence planning decisions and local land use policies, the HSE's aim is to stabilise the local population at risk in the short term and to reduce the risk in the long term.

In practice however, local planning authorities have to balance the need to protect lives with other issues such as urban renewal, derelict land reclamation and the need for economic growth and increased levels of employment.

When confronted with the prospect of losing investment, jobs and prime building sites a number of local authorities have tended to err in favour of the proposed development. If this trend were to continue the aims of the HSE would not be achieved.

Hazardous Developments in Cheshire

The problems of blight may usefully be illustrated by focussing on Cheshire where there are 64 hazardous developments. Around each of these sites is a consultation zone which has been prescribed by the HSE and within which local planning authorities are

requested to seek advice on the anticipated level of risk before granting planning permission for certain types of development. Some of the hazardous sites are located in clusters and some are located close to town centres or within mixed residential and commercial areas such as Ellesmere Port, Widnes and Runcorn. Others are located in less populated areas.

Hazardous Developments in Ellesmere Port

Most of the Ellesmere Port area is built up with little vacant land. A number of hazardous developments are located to the north east of and within two kilometres of the town centre and the most significant of these is a company which handles large quantities of chlorine and which has been the subject of a detailed *Development Control Guidance Note* by the HSE.

The two consultation zones — referred to as Zones 1 and 2 — which extend to 1,000 and 1,500 metres respectively from the hazardous installation cover a population of around 14,500.

Within Zones 1 and 2 which also cover the town centre, the main shopping area and an extensive residential area, the HSE recommends that any proposal to build new hospitals, schools, elderly persons homes, sports stadiums and significant residential developments, should be refused. In addition, the HSE would wish to be consulted on proposals for large retail developments and places of entertainment. Quite clearly the recommendations made by the HSE has a potential blighting effect on the future development programme for Ellesmere Port and, if accepted, would lead to an unrealistic constraint on development. This would seriously affect the need to provide a variety of land uses in the right place and at the right time to support the local community. The County Council also provides services for the local community and there are currently 15 schools and six residential homes and day centres within Zones 1 and 2. On the basis of HSE advice it is anticipated that most of these establishments, if proposed, would be recommended for refusal.

The Borough Council has made one or two recent decisions to approve planning applications despite recommendations for refusal and this is an indication of its determination to support the existing community and to avoid stagnation in this area. If this trend were to continue then the County Council would be obliged to maintain the same type and level of local services in the same neighbourhood.

It is important therefore that a review is carried out to determine the measures needed to achieve acceptable development control policies in such areas without increasing the number of people at risk.

Hazardous Developments in Halton

The Borough of Halton covers Widnes and Runcorn and is another district in Cheshire which is facing problems of blight. There are 15 hazardous developments in Halton which are mainly concerned with the storage and handling of chlorine, phosgene, sulphur dioxide and liquid petroleum gas. In addition, there are ethylene and high pressure gas pipelines running through the district. One of the plants in Runcorn which is

located within 300 metres of houses and which stores around 450 times the notifiable level for chlorine, is potentially one of the greatest industrial hazards in Western Europe.

A major part of the Borough including the town centre, shopping areas and residential areas, lies within the overlapping consultation zones of a number of hazardous developments. Although the HSE has been recommending refusal at a rate of approximately one planning application per month on hazardous risk grounds the Borough Council has felt it necessary to approve many of the applications because of the need for a variety of developments in the district and because of the lack of attractive alternative sites. On one occasion a large retail store in Widnes was given planning approval despite opposition from the HSE. The ten hectare site which was valued for industrial purposes at up to £250,000 was eventually sold for £1 million. If approval had not been given for the retail store then the opportunity cost of £750,000 for the land and the valuable strategic location of the site for this use, would have been lost.

With extensive consultation zones affecting around a sixth of the resident population in Runcorn and Widnes, the likelihood is that the local planning authority will continue to be confronted with the same conflicting issues and will continue to make planning decisions which are not supported by the HSE. Unless further guidance and assistance is provided to permit acceptable planning solutions to be found, then the need to utilise the assets of the district, the need to increase jobs and the need to provide a balanced development programme, will mean that more people will be exposed to unacceptable levels of risk.

Possible Solutions

(a) Planning Agreements and Low Population Land Uses

In order to resolve these issues Cheshire has looked at a number of options available. The Advisory Committee on Major Hazards suggested the use of planning agreements and the use of low population land uses for intervening parcels of land. However, neither of these methods has proved successful in the UK due to the heavy financial penalty that would be imposed on developers and the need to take account of the commercial value of strategic sites near town centres.

(b) Hazardous Substances Consent Controls

A further consideration to solve the blight problem could be additional legislation. When the *Hazardous Substances Regulations* are promulgated there may be some scope for local planning authorities to reduce the level of risk to the community by controlling both the volume and the location of hazardous substances held on individual sites. In practice however, the new Regulations will probably have a limited effect due to the exemption clause for existing installations which permits a two fold increase of inventories held on the sites during the year prior to the operation of the Regulations.

(c) Further Action by the Health and Safety Executive

It should be a pre-requisite that hazardous industries remain responsible for the level of hazard risk which prevails both on and off the site. When difficult planning circum-

stances are encountered then it may be appropriate for HSE to impose or negotiate greater controls on industry to reduce the off-site risk. In addition the HSE should adopt a more rigorous control policy by asking the Secretary of State to “call-in” any planning application which has been approved by the local authority despite a recommendation for refusal. Although this approach would enable the local authorities to rely on independent directions from the Secretary of State the consequence of holding a public inquiry would be to relinquish local control. Nevertheless, there would be the opportunity to bring the issues of blight more evenly into the planning debate and it would also ensure that expert opinion was made more accountable.

Indeed, the opportunity to balance the various planning issues against the hazard risk issues in a formal or informal forum and in the wide context that a comprehensive environmental assessment would provide, would permit additional options to be put forward to help bring together the polarised viewpoints which currently prevail.

(d) Compensation

Whilst individual development proposals could be dealt with in this way an alternative approach would be to provide a procedure which would enable a local planning authority to submit case studies on blight around individual hazardous developments. This would direct attention on the need for industry to pay for reducing blight.

However, it is unlikely that this approach will be successful on its own and, where appropriate it may be necessary to consider the availability of some form of financial assistance to the developer, or to the existing hazardous industry or to the local planning authority in order to obtain grants and loans which could be used for reducing the risk or for reducing the number of people at risk.

Cheshire County Council had been wondering how such compensation payments could be made. It became apparent that a number of similar blight situations had been resolved previously by three types of method:

1. Relocation of the hazardous industry from the urban and town centre area.
2. Relocation of sensitive buildings away from the hazardous site as part of an agreed hazard planning strategy.
3. Reduction in the inventory of the stored hazardous substance on the site or an improvement to the activities and processes on the site.

The Advisory Committee on Major Hazards suggested that the Secretary of State should re-examine the discretionary powers for making central funds available for reducing hazard risk. Although there are precedents for each of the aforementioned types of compensation in Northern Ireland, Cardiff, Dunfermline, Hartlepool and Middlesbrough and although a small number of local planning authorities have succeeded in obtaining financial assistance to remove blight, there remains no recognised procedure or guidance on this matter.

It is recognised that there are problems in seeking to relocate the hazardous industry and in seeking to relocate sensitive land uses away from the hazardous site. Such methods may be useful depending on local circumstances but only when other considerations

have been discounted or where there are linked opportunities. The most common method of compensation which appears to offer the greatest benefits is one which permits a reduction in the inventories of stored hazardous substances or improvements to the processes and activities on the site.

Sources of Finance

If the Government is to be asked to address the problem of blight and ultimately to consider how such development restrictions can be removed, then an appropriate review body should direct attention to the sources of funding needed for such measures.

Financial assistance could be made available in the form of grants from a rolling fund organised by the Department of Environment. Alternatively, bids may be available from the European Commission which has implemented a five year programme for funding environmental protection projects where there is a potential to create jobs. In addition the European Investment Bank has announced the availability of loans for similar projects.

At the moment it is up to individual local authorities to investigate whether such funds could be utilised for removing hazard blight. In future it may be better if either the Government or a government agency could determine the criteria needed to enable all local planning authorities to make legitimate claims.

Financial assistance is always likely to be limited and therefore it should be directed towards situations where the greatest benefits will result. Unlike the availability of Urban Development Grants it should not be limited to certain geographical areas but regulated on a "needs" basis.

Summary and Recommendations

Whilst industry in the UK can boast of a successful off-site safety record, the blighting effects of hazardous developments on neighbouring communities is significant. Although the number of recommendations for refusal by the HSE are relatively few, the size and location of the consultation zones is inhibiting urban developments. In such locations local planning authorities are faced with the difficult task of deciding between environmental protection and economic development, when in reality both are essential ingredients for the future prosperity and enjoyment of a community. With the need to permit a realistic balanced development programme and the need to avoid urban stagnation, the local planning authority is inevitably being forced to downgrade the hazard potential and to subject an increasing number of people to unacceptable levels of risk.

Whilst there is a need to retain development control decisions at the local level, the government should recognise the need to investigate blight caused by industrial hazards and should convene an appropriate body to identify a practicable solution to this intractable problem. Any investigation should consider the role of the HSE and the responsibility of the hazardous industry. In addition the views of the European Commission should be sought to consider the international implications of taking action to remove blight on trade and industry and to consider the opportunities arising from the establishment of a European Fund for this purpose.

A strategy to reduce or remove blight will not only provide a safer community but will also support a wide and varied urban infrastructure which is necessary to promote economic and social growth in the area and to boost investment confidence. Whilst there are examples of the successful removal of blight from town centres and urban areas these have been dealt with previously by an ad hoc approach. A more systematic approach is preferred which would enable local planning authorities to make a formal submission to the Government on specific cases of blight.

Accordingly, it is recommended that the Local Authority Associations should jointly request the Secretary of State to set up an appropriate body to review the issues and implications of blight caused by hazardous development in particular to:

- a) determine a procedure for dealing with blight and to examine the role that the Health and Safety Executive would play in determining the options available in conjunction with the local planning authorities and hazardous industry;
 - b) consider the most appropriate sources of finance and the criteria by which funds would be used to reduce the level of unacceptable risk to the populations surrounding hazardous developments.
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LETTER TO THE EDITOR

CLEAN AIR ACT 1956 SMOKE EMISSIONS – HOSPITAL BOILERPLANT

I thought it might be interesting for *Clean Air* readers to have some details of the City of Worcester's involvement with smoke emissions from a local hospital boilerplant.

Three years ago oil fired Lancashire boilers at a local hospital were replaced with coal fired package boilers with underfeed stokers. The works being undertaken by a company who had obtained, as a result of competitive tendering, a contract to supply steam to the District Health Authority. The health authority retaining ownership of the fabric of the boilerhouse, the chimney and utility connections but the operating company own and maintain the boilers.

Over the last twelve months a number of observations revealed dark smoke emissions in excess of the statutory limits and accordingly the City Council have made representations to the Secretary of State in accordance with Section 22 of the *Clean Air Act 1956* which sets out the procedure for dealing with crown premises, in addition to calling for the removal of crown exemption from all pollution control legislation.

Counsels opinion was also sought over whether legal proceedings could be taken against the operating company.

Counsel's written advice has been received and the following passage is quoted from his conclusions:-

“Whilst the matter is not free from doubt I take the view that the Court is more likely than not to find that the company qualifies as the occupier in this statutory sense because

- (a) it owns the boiler;
- (b) it is solely responsible for the operation of the boiler;
- (c) free access to the boiler by the company is contractually guaranteed;
- (d) looking at the word “possession” of the boiler *in the context of this particular statute* it is plain, having regard to the imposition of statutory liability, it notes a degree of control over the operation of the boiler which the company has, and which the Area Health Authority does not have;
- (e) this last point is reinforced by the Section 34(3) definition of “occupation” which, although referring to separate parts of the building, invokes the reference to the person having “control” and in the instant circumstances this is plainly the company.
- (f) “occupation” by reference to “control” has a well established legal pedigree in statutes designed for the protection of persons, e.g. the *Factories’ Act 1961*. Although there is no definition of “the occupier” in the *Factories Act* the authorities make it clear that the test is, in one word, “control” see the cases cited in *Monkman Employers Liability* 10th Ed. p250;
- (g) finally, one can test the proposition by seeing whether the only other candidate for “possession”, namely the Area Health Authority premises and the Area Health Authority has the “key to the door”. That said the Area Health Authority neither owns it nor operates it nor, it may be assumed, ever interferes with it in any way and cannot sensibly be held to “possess” this boiler, although it possesses clearly the product of it namely the energy produced”.

Even if he is wrong on this point Counsel concluded that the company rather than the Health Authority is “the occupier of the building” for the purposes of the *Clean Air Act*. Counsel states “The reason is that occupation for the purposes of the *Clean Air Act* connotes “control” both as a matter of purposive construction of the provision and by reference to Section 34(3) of the 1956 Act and that it is plainly the company rather than the Area Health Authority which controls the particular building.

If you or any member authority requires any further information, please do not hesitate to contact me.

R.I. Key, Principal Environmental Health Officer

UPDATE

ENVIRONMENTAL PROTECTION BILL

The Commons Committee considering the *Environmental Protection Bill* was expected to report during April with the first and second reading of the Bill in the Lords taking place in late April/early May. There have been no major amendments to the Bill.

The Government has also published a number of proposals in relation to various sections of the Bill:

HMIP Cost Recovery

The Environment Minister, David Trippier, announced in January that industrial firms will be charged for discharge licences on the basis of their pollution potential. The higher the level of polluting wastes to be discharged to air, water or land, the higher the licence fee. The cost recovery scheme, which was the subject of a Department of the Environment consultation paper in July 1988, will be implemented as part of the proposals for integrated pollution control in the *Environmental Protection Bill*. New licences will cost £1,500 a component; existing licences will be charged at £1,000 plus £400 a year for renewals.

The system will cover the costs of inspection, monitoring and amendments of authorisations under IPC. Detailed information on expenditure and performance will be published so that HMIP's operating efficiency can be examined. HMIP will also monitor their resources employed in dealing with dif-

ferent categories of authorisation to check for anomalies; the structure and level of the charges will then be reviewed in the light of experience.

It is hoped to introduce the new charging system, which applies only in England and Wales, in April 1991. Comparable proposals are being considered for pollution controls in Scotland; legislation for introducing IPC and a related charging system in Northern Ireland is also under consideration.

Schedules of Prescribed Processes and Substances

Clause 2 of the *Environmental Protection Bill* provides for regulations to prescribe processes and substances which are to be subject to integrated pollution control by HM Inspectorate of Pollution and processes subject to local authority air pollution control, Part A and Part B processes respectively. The Department of Environment has now produced a first draft of the processes and substances to be scheduled; this is largely based on their 1986 and 1988 consultation papers reviewing air pollution control in Great Britain, although a number of modifications have been made.

There will be three separate lists of prescribed substances — one for each of the three media: air, water and land. The list of air substances will apply to both the integrated pollution and air pollution control regimes established under Part I. Under clause 5(2) of the *Environmental Protection Bill* enforcing authorities will be required to include

conditions in authorisations which achieve a series of objectives. These objectives include the use of Best Available Techniques Not Entailing Excessive Cost (BATNEEC) to prevent or minimise releases of *prescribed* substances into the relevant environmental medium, and to use BATNEEC to render harmless any releases into the environment, *whether of prescribed or any other substances*.

Access to Information

Despite fears by some industries that commercial secrets could be put at risk, Environment Secretary, Chris Patten is to insist on full disclosure of raw data by scheduled plants and processes. This will apply to both those licensed by HMIP under the new arrangements for integrated pollution control and those covered by local authorities. Under the *Environmental Protection Bill*, the public registers, which will be open to anyone to consult free of charge, will be compiled by HMIP and local authorities. Details of the licence, emission limits and monitoring requirements, enforcement action for breaches of the licence, as well as full details of how the company meets the licence requirements will have to be included.

A draft guidance note on commercial confidentiality for the purpose of public access to information under IPC was published at the end of January. This says "there must be a presumption in favour of unrestricted access for the public to information which the pollution control authorities obtain or receive by virtue of their statutory powers with provision for secrecy only in those cases where a genuine case for it can be substantiated. If the Secretary of State receives an appeal against a decision by

an enforcing authority not to withhold information from the IPC register, he will require cogent and specific evidence to substantiate the claim that disclosure would prejudice to an unreasonable degree some person's commercial interests."

Duty of Care Code

The Government has published a draft code of practice aimed at curbing the illegal disposal of waste. The code will be used for practical guidance in implementing the new duty of care contained in the *Environmental Protection Bill* (Clause 26).

The code gives advice and examples on the practical measures that those under the new duty should take, for example:

- waste left out for collection or being transported should not be allowed to blow around or fall off, it should be put in containers or covered up securely;
- all firms which produce waste should know what it is composed of, or should commission an analysis;
- firms should check up on the bonafides of anyone they give their waste to; they should see and check their certificate of registration as a carrier or their waste management licence;
- if firms see or suspect that someone is fly-tipping their waste, they should stop handing any waste to that person and warn the local authority;
- if anyone knows that their waste requires special treatment, for example clinical waste from hospitals (the NHS will not be exempt), then they must take action to ensure that it receives that treatment.

ENVIRONMENTAL PROTECTION AND WATER STATISTICS

In March, the Department of Environment published its annual digest of statistics covering the state of the Environment. Data included is that available at December 1989, and therefore mostly relates to 1988; figures generally refer to the whole of the United Kingdom. Among the wide variety of statistics are the following:

Sulphur Dioxide and Smoke

In 1988, UK sulphur dioxide emissions fell by 5% to 3.66 million tonnes, of which power stations were responsible for 71%. Emissions from large combustion plants fell 6% to 3.06 million tonnes in 1988 and were 21% below the 1980 baseline level: the EC Large Combustion Plants Directive requires a 20% reduction from the 1980 level by 1993.

In 1988 UK black smoke emissions, included in the Digest for the first time, were 533 thousand tonnes, a reduction of 7 thousand tonnes from 1987. Of this domestic emissions were responsible for 42% (223 thousand tonnes) (1987: 58% or 247 thousand tonnes). However, emissions from road transport were responsible for 34% (184 thousand tonnes) of the total in 1988. In 1987 road transport emissions accounted for only 18% of the total (167 thousand tonnes). These changes are reflected in the analysis by fuel type which show that between 1978 and 1988, the contribution to black smoke emissions from coal combustion fell from 63% to 47% and that diesel rose from 17% to 32%.

It is worth noting that since most towns are smoke control areas where domestic sources will only have a small

contribution to smoke levels, it is clear that diesels will be the major source of smoke in most urban areas. In addition, diesel smoke is considered by Warren Spring Laboratory to be *three times* more soiling than coal smoke, and is thus the major culprit in soiling buildings.

Nitrogen Oxides

UK nitrogen oxide emissions rose from 1984 to reach 2.48 million tonnes in 1988. The main emission sources are road transport and power stations, responsible for 45% and 32% respectively. Emissions from large combustion plants fell 3% in 1988 and were 11% below the 1980 baseline level. The EC Large Combustion Plant Directive requires a 15% reduction from the 1980 baseline level by 1993.

Volatile Organic Compounds

For the first time figures are presented separately in the Digest, and show that UK emissions of VOCs in 1988 were 1.85 million tonnes. The main emission sources are processes and solvents (57%) and road transport (30%). Future EEC Directives will reduce VOC emissions from new cars by 1993.

Carbon Monoxide

Between 1984 and 1988 emissions of CO have risen steadily to reach 5.51 million tonnes in 1988, with road transport being responsible for 85% of the total.

Lead

UK emissions of lead from petrol-engined vehicles fell by 60% between 1984 and 1986 to 2.9 thousand tonnes following the reduction in the lead content of petrol at the end of 1985. Emissions

sions rose slightly in 1988 to 3.1 thousand tonnes reflecting the increase in petrol consumption. Unleaded petrol clearances from bonded warehouses rose during 1989 from 3% of total clearances to 28%. It is estimated that total lead emissions will fall by 15% in 1989 to 2.6 thousand tonnes.

Average airborne lead concentrations fell by 55% between 1985 and 1986 following the reduction of lead in petrol at the end of 1985.

Noise

As expected complaints about noise from domestic premises increased by nearly 40% between 1986/87 and 1987/88. This represents a total of 59,132 complaints, with amplified music and barking dogs together accounting for two-thirds.

Complaints relating to noise from industrial and commercial premises have more than doubled over the past decade and those for roadworks, construction and demolition quadrupled.

Waste

Total waste arising in the UK each year is currently estimated to be about 500 million tonnes, of which half is agricultural waste. The amount of glass reclaimed from all sources, including industry, rose from 128,00 tonnes in 1983 to 275,000 tonnes in 1988 and accounted for 16% of glass consumed in manufacture. The weight of recycled paper and board increased steadily between 1983 and 1988 although its proportion of total consumption remained steady at around 26%. Some 52,000 tonnes of hazardous waste (capable of harming living organisms or the environment) were imported in the UK in 1988/89 compared with 80,000 tonnes in 1987/88.

SPECIAL WASTE

The Department of the Environment has published proposals for amending the *Special Waste Regulations 1980* to strengthen and improve existing controls for disposal of dangerous waste. The main changes on which views are sought are:

- a new, broader definition of special waste. In future, special waste will be defined by reference to 11 characteristic properties and will explicitly include substances which present an immediate, delayed, or accumulative risk to the environment as well as those harmful to human health. It will also include clinical waste; *+ household.*
- a requirement that, before special waste is removed from the producer's premises, there must be a contract which ensures its disposal at an appropriately licensed site;
- a requirement on disposal authorities to recover a reasonable charge for consignment note forms, including the cost to authorities of administering and monitoring the operation of the consignment note system;
- a prohibition on disposers accepting special waste unless they have contracted to do so and have a licence which authorises its disposal. On rejection of a consignment, the carrier will be required to return it, without undue delay, to the person from whom he collected it;
- a prohibition on carriers mixing different consignments of special waste. Disposers will be prohibited also from mixing special waste with non-special waste, except for the

purpose of improving safety during disposal, or ensuring that it is disposed of without causing danger to public health, serious detriment to local amenities or risk to the environment; and

- a requirement on disposal authorities to keep public registers of consignment notes for each licensed site in their area. Safeguards will be provided to prevent the disclosure of information which would prejudice, to an unreasonable degree, the producer's commercial interests.

The provisions relating to controlled waste and special waste at present contained in Part I of the *Control of Pollution Act 1974* will be repealed on the implementation of the *Environmental Protection Bill*. However, sections 17(1) and (2) of the 1974 Act will be re-enacted with amendments, where necessary, to take account of the measures previously announced or proposed, for example, the establishment of waste regulation authorities and charging for consignment notes.

ASBESTOS IN THE AIR

The *Control of Asbestos in the Air Regulations 1990*, which came into force on 5 April 1990, implement the air pollution aspects of EC Directive 87/217/EEC on the prevention and reduction of environmental pollution by asbestos. Following submissions on the draft Regulations (circulated last year), the date of implementation in respect of existing plants has been postponed to 30 June 1991 (the latest implementation deadline allowed by the Directive) to allow more time for firms to phase out completely the use of asbestos in certain products. In addition, the application of

the emission limit has been extended to cover all discharge outlets, and not simply discharge ducts as originally proposed.

The Regulations apply an emission limit of 0.1 milligrammes per cubic metre of air to all activities involving the "use of asbestos", as defined in regulation 2(2). These processes are already scheduled for control by HMIP in England and Wales and HMIPI in Scotland, under the *Health and Safety (Emissions into the Atmosphere) (Amendment) Regulations 1989*. The definition of these scheduled processes includes the industrial finishing of the products even when the activity is not an integral part of a manufacturing plant, i.e. when the finishing is carried on at separate premises or by a different company.

HMIP/HMIPI will be issuing a guidance note containing comprehensive details of the requirements for those processes which are scheduled as "Asbestos Works".

DoE RESEARCH PROGRAMME

For the year 1990/1991, the Department of the Environment has allocated £37 million (an increase of £5 million) to its research programme. This will include new work on climate change, waste management, North Sea pollution, environmental economics and genetically manipulated organisms in the environment.

The Department's *Air Quality* research programme, (£6.9m) will include the assessment and modelling of air pollution emissions and deposition, the quantification of air pollution effects and will support air quality monitoring programmes. The *Global Atmosphere*

research programme (£6.6m) will, in conjunction with research undertaken by the Meteorological Office and the Research Councils, provide scientific advice to the Government on climate change and on depletion of the ozone layer. The programme will provide the resources to establish the Centre for Climate Change Prediction.

Controlled Waste Management research (£3.62m) will cover both the handling, treatment and containment of waste and toxic waste and the protective measures required against the risks posed by contaminated land. The main research on toxic waste is the evaluation and detoxification processes, while the main research on landfilling practices covers the characteristics of the processes occurring within landfill sites and the mechanisms of the generation of leachate and gas. Investigation of a range of systems for waste processing, including incineration and biological treatment will continue and a significant increase is planned in the research on the movement of landfill gas in soils and buildings and the provision of data to assist with design of protective measures.

The Department's *Noise* research programme (£0.62m) will provide information about the overall trends in environmental noise and on public attitudes to noise. A significant part of the programme is aimed at improving the assessment of the disturbing qualities of noise. Almost half of the provision for the programme in 1990/1991 will be to meet the cost of new survey work which will provide information on the noise climate in England and Wales and determine the national incidence of disturbance from a wide range of environmental noise. Other new work proposed for

the 1990/1991 programme includes research on the criteria for evaluating noise annoyance at low frequencies.

Other areas covered by the research programme are radioactive substances, toxic substances, water and a survey of the countryside.

RADON ACTION LEVEL HALVED

The Government has accepted the National Radiological Protection Board's (NRPB) advice that the level above which action should be taken to reduce exposure to radon in dwellings should be halved. The NRPB now considers that in view of upward revisions of internationally-accepted risk estimates for radiation-induced cancers, the level above which action should be taken to reduce radon should be halved, from 400 to 200 becquerels per cubic metre.

In announcing the reduced action level, David Trippier (Minister of State for the Environment) said that, home improvement grants would continue to be available for treating existing houses to reduce the radon concentration, and that advice on handling grant applications was sent to local authorities in February 1989. The current grant scheme in England and Wales ended on 1 April 1990. Now, discretionary grant aid will be available under the new system of renovation grants where radon concentrations exceed the Action Level of 200 becquerels per cubic metre. In addition, the programme of field trials on remedial measures in existing houses currently being carried out by the Building Research Establishment will enable the Government to publish further advice this year. An additional programme of research on houses with

radon concentrations between the old and new action levels is to be carried out over the next two years.

OCCUPATIONAL EXPOSURE TO RADIATION

The Health and Safety Commission has published a consultative document setting out draft guidance for employers on measures to maintain levels of protection for employees against ionising radiations. This move is part of an adjustment to the international scientific community's perception that the risks from such radiations are higher than previously estimated. The National Radiological Protection Board (NRPB) has already recommended that individual occupational exposures should be controlled so as not to exceed 15 millisieverts (mSv) a year on average. The current annual dose limit is 50 mSv per worker as set in the *Ionising Radiations Regulations 1985*.

The proposed guidance aims to draw the attention of employers to the possibility that risks arising from exposure to ionising radiations may be two or three times greater than previously thought. This would have implications for the requirement placed on employers by the Regulations to reduce exposure to as low a level as reasonably practicable. The second aim of the proposed guidance is to provide for an investigation to be set up by an employer when any employee receives a total cumulative dose of 150 mSv within any ten consecutive calendar years. There is already provision in the Regulations for an investigation when the dose reaches 15 mSv in a single year; but this essentially focuses on the engineering controls and work practices leading to that dose. The new investigation would focus on the indi-

vidual, involving consultation with, for example, an appointed doctor and/or a trade union representative and would lead to a decision on the future pattern of work for that employee.

Following consultation, the HSC intends to publish the guidance as part of an Approved Code of Practice, which would give employers authoritative advice on complying with the *Ionising Radiations Regulations*.

Since publication of the HSC consultation document, the International Commission for Radiological Protection (ICRP) an independent body of scientists, has suggested keeping the annual dose limit at 50 mSv, and over five years introducing a maximum limit of 100 mSv — an annual average of 20 mSv.

VEHICLE EMISSIONS

The European Commission has proposed a new Directive for exhaust emissions for vehicles as strict as those which apply in the USA, to take effect from 1 January 1993.

In future the emission standards will be expressed in grams per kilometre (g/km) rather than grams per test. As a result, the overall limit values which all cars will be required to meet are proposed as follows:

Type approval: CO 2.72g/km; HC + NOx 0.97g/km; Particulates 0.19g/km.

Production Conformity: CO 3.16g/km; HC + NOx 1.13g/km; Particulates 0.24g/km.

For the first time proposals to control evaporative emissions are included. Controls on hydrocarbons or volatile organic compounds (VOCs) which evaporate from the fuel tank and fuel sys-

tem will require the fitting of "carbon canister" technology to cars from 1992. Already standard in the US and Japan, canisters allow the car fuel system to breathe but absorb VOCs — which are implicated in the formation of photochemical smog and ground-level ozone. In Europe around 10% of man-made VOCs come from this source. Canisters are relatively cheap to fit and are unlikely to increase the cost of new cars significantly. The Commission is also planning further controls on VOC emissions from the distribution and storage of petrol, which is responsible for a smaller percentage (5-7%) of VOC emissions. NSCA has campaigned for carbon canister technology to be mandatory and welcomes the EC proposals; we trust that the UK Government will warmly support them.

A second, stricter stage of particulate limits for diesel cars is proposed to be 0.8g/test for type approval and 1.0g/test for production conformity. This is easily achievable using existing technology and could be further tightened.

Changes are also to be made in the test driving cycle on which vehicle emission standards are based, in order to reflect higher out-of-town driving speeds. It was the prospect of such a test which put paid to the hopes for lean-burn engines, which currently produce high levels of NO_x at higher speeds.

The Directive makes proposals on standards for the durability of anti-pollution devices such as catalytic converters. Environment Commissioner Carlo Ripa di Meana indicated recently that he will be looking for an annual test in order to ensure that catalysts continue to function efficiently. NSCA has called for such emission tests to be included in the annual MoT test. The Department of

Transport is at present consulting on new regulations which will require car owners to keep emission control systems in good working order and prevent tampering.

COMPLIANCE WITH EC DIRECTIVES

EC Environment Commissioner, Carlo Ripa di Meana, has criticised Member States for their poor record in implementing EC environmental directives into national laws by the required dates. Denmark has the best compliance record with only five complaints, while Spain the worst offender, faces prosecution for non-compliance with 57 directives; although France, Greece, Belgium and Italy all have worse records, the UK which is facing prosecution for non-compliance with 31 environmental directives, does however have the worst record for compliance with air and water pollution directives. The EC Commissioner has also called for powers to enforce judgements made by the European Court of Justice against countries found to have broken Community legislation.

NEW TIMETABLE PROPOSED FOR OZONE DEPLETERS

The European Commission has proposed a tougher timetable for eliminating ozone depleting chemicals. The new timetable calls for CFCs to be banned by 1998, halons by 2000, carbon tetrachloride (not covered by the 1987 Montreal Protocol) by 1998; it also proposes that the production of methyl chloroform (also not listed in the Montreal Protocol) should be cut to 60 per cent of 1986 levels by 2000. It is likely that Ministers will delay any final decisions until after revisions to the Montreal Protocol have been considered in June.

NOISE REVIEW

A Department of Environment working Party has now begun reviewing existing controls on noise with a view to producing preliminary conclusions in time for them to be taken into account in the Environment White Paper due for publication later in the year.

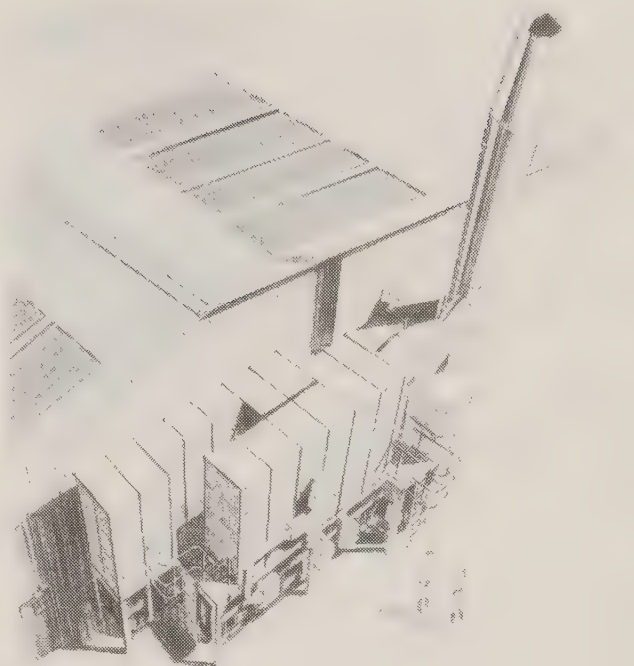
The Review is wide-ranging, covering all aspects of noise abatement and control, except issues relating to aircraft noise and noise from defence establishments. Particular issues likely to be covered include increasing the powers and responsibilities of individual citizens to control noise nuisance; effective provisions for local authorities to deal with neighbourhood noise; car and burglar alarms; the state of research concerning ways of measuring noise and assessing its effect; and advice on planning and noise.

NSCA is represented on the Working Party by Geof Kaufman (Tameside MBC).

REVISION OF BS 6472: 1984 DRAFT STANDARD

This Standard, which provides a guide to evaluation of human exposure to vibration in buildings (1 Hz to 80Hz) has now been released in draft form for public comment. Broadly speaking, the Standard remains very similar to its original 1984 form, but there is a new appendix related specifically to blasting and more explanation is given on the use of vibration dose or root mean quad.

The draft now acknowledges that it is acceptable to carry out field evaluation with appropriate instrumentation, although the preferred technique is still to determine values from unfiltered



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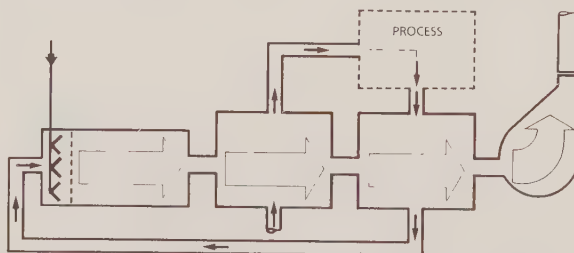
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recorded times. Advice on the location for measurements is amplified compared to the original Standard but the two most significant changes as mentioned are in relation to vibration dose and the blasting annex. An appendix now gives worked examples of the calculation of vibration dose and of the correction factors that should be applied which is a considerable improvement over the reference to vibration dose in the 1984 document.

A second appendix relating specifically to vibration from blasting provides detailed guidance on vibration measurements and factors influencing human response. It then proceeds to suggest satisfactory vibration magnitudes and develops, by way of worked examples, a 90th percentile concept.

Copies of the Draft are available from the BSI at a cost of £4.00 to members and £8.00 to non members.

EUROPEAN CHARTER ON ENVIRONMENT AND HEALTH

In December 1989, Ministers of Environment and Health from 29 European countries met to formally approve and sign a Charter on Environment and Health. The Charter drawn up under the auspices of World Health Organisation addresses organisational and scientific questions as well as the entitlements and responsibilities of individuals and different sectors of society and should be seen as part of WHO's strategy for health for all in Europe.

The preamble to the European Charter acknowledges the dependence of human health in a wide range of environmental factors and the benefits that accrue from a clean and harmonious environment. It expresses concern at the

ill-considered use of natural resources and man-made products and makes the point that the maintenance and improvement of health and wellbeing require a sustainable system of development.

An important section of the Charter is devoted to entitlements and responsibilities. The Charter says that every individual is entitled to information and consultation on the state of the environment and on plans, decisions and activities likely to affect both the environment and health and also that every individual is entitled to participate in the decision-making process. The responsibilities of individuals and of public and private bodies to contribute to protecting the environment and safeguarding human health are laid down and the role of the media is emphasised in promoting awareness of a positive attitude towards protection of health and the environment.

The Charter then lays down a number of priority areas to which governments, the European Community and other intergovernmental organisations, as appropriate, should pay particular attention. These include the implications to human health of global disturbances to the environment, urban development, planning and renewal together with air and water pollution, food safety, the control of persistent chemicals and hazardous wastes, biotechnology, contingency planning for accidents and the introduction of cleaner technologies as preventative measures. The importance of determining the health impacts of various energy options, of road transport and of various agricultural practices is emphasised.

A section of the Charter encompasses principles for public policy, and

acknowledges that physical, psychological, social and aesthetic factors must all be given due importance and emphasises that the environment should be regarded as a resource for improving living conditions and increasing wellbeing. It stresses that the health of *every* individual, especially those in vulnerable and high-risk groups must be protected.

The Charter, a detailed commentary on it and other relevant material may be obtained from the Regional Office for Europe, World Health Organisation, 8 Sherfigsvej, 2100 Copenhagen, Denmark.

INDUSTRIAL NEWS

WASTE DATABASE

The Waste Management Information Bureau, has launched a new database on ORBIT Search Service. Known as WasteInfo, and produced by AEA Technology at its Harwell Laboratory, the database contains 56,000 bibliographical records covering all aspects of non-radioactive waste management.

It has been designed as a working tool for all professionals involved in waste management, the environment and the implementation of pollution control measures. WasteInfo identifies new areas for research, business opportunities and national and international initiatives by providing comprehensive coverage of environmental issues, including:

- waste disposal and treatment: landfill, incineration, biological/chemical treatment, separation techniques;
- waste recycling: refuse-derived fuel, landfill gas, plastics/metals, reclamation of contaminated land/ground water;

- environmental hazards and impact: CFCs, PCBs, landfill gas, explosions, oil spills, acid rain.

Also included are waste management policy, guidelines, legislation, regulations and economics, along with information on companies offering services and products in the waste management field.

Reader Enquiry Service No. 9004

LANDFILL GAS MONITORING

Geotechnical Instruments of Leamington Spa has introduced a new system for monitoring landfill gas. A self-contained sealed unit uses advanced technology based on the laboratory method of infra-red absorption for quantitative analysis. The system does not require an external power system and can be placed in boreholes. It can be used as a stand alone device or as part of an integrated monitoring network. A more advanced unit includes an automatic alarm system for signalling dangerous levels of gas.

Reader Enquiry Service No. 9005

SMOKE CONTROL

Advanced Environmental Systems of East Sussex has developed a new wet scrubbing system for smoke pollution that uses less energy than traditional venturi scrubbers. The new Microdyn system utilises a special spray to reduce the droplets to the most effective size for efficient scrubbing and removes smoke particles down to 0.15 microns without expending large amounts of energy. AES guarantees that the system is designed to conform to the complex legislation emanating from the UK and from the European Community to control air pollution.

Reader Enquiry Service No. 9006

HEALTHY BUILDINGS

The Building Research Establishment is looking at the possibility of an "environmental assessment for buildings encompassing internal and external environments". Developers would be able, for a fee, to have their building assessed at the design stage for the presence of, for example, carbon dioxide and other noxious emissions and CFCs in materials and air conditioning.

Reader Enquiry Service No. 9007

COSHH HELPLINE

The need for construction companies to be aware of, and reduce the health risks from exposure to hazardous substances used by their employees, sub-contractors and indeed the surrounding population has led to the establishment of a Helpline for the building and construction industry. The COSHH Helpline has been devised by the Building Advisory Service and Environmental Management with the advice of the Building

Employers Confederation. It links in with the Confederation's guide, *COSHH in Construction*. COSHH Helpline advisers have access to a database of hazardous substances compiled specifically for the construction industry; enquiries can be dealt with by telephone or for more complicated problems, Assessment Data Sheets are available on request.

Reader Enquiry Service No. 9008

NOISE AT WORK

Wimpey Environmental has produced an easy-to-follow guide to help employers meet the somewhat complicated requirements laid down in the 1989 *Noise at Work Regulations*. Starting with the question "Do you need to raise your voice anywhere within your company to be heard?" a series of yes/no responses lead employers through the guide; showing them what measures they must take in order to satisfy the Regulations.

Wimpey Environmental believes that the guide provides a valuable first step in reducing noise pollution in places of employment from office suites through to factory floors. If necessary, Wimpey's consultancy and monitoring services can then be called in to assess the problem, measure noise levels and advise on ways to remedy the situation.

Reader Enquiry Service No. 9009

NOISE CHECK

'Site Sound Check' is a new consultancy service from Environmental Management and the Building Advisory Service to assist building employers to comply with the new *Noise at Work Regulations* which came into force in January 1990. Site noise surveys, industrial audiometry as well as guidance on noise reduction

techniques and advice on suitable hearing protection are all part of the service. Noise measurement equipment can also be hired and sites can be monitored before work begins to establish background noise levels.

Reader Enquiry Service No. 9010

COST EFFECTIVE MEASUREMENT OF CFCs

Widespread concern about the use of CFCs — halogenated hydrocarbons — throughout industry and their potential effect on the earth's ozone layer has led to calls for an accurate and simple method of measuring these gases in the atmosphere. CFCs — principally Freon

and Halon — are used in gas or liquid form in many applications, including refrigeration, fire-fighting, packaging and degreasing.

Draeger, manufacturers of detector tubes and instruments for the detection and monitoring of oxygen and other gases, has now developed a new detection tube which provides a simple and inexpensive method of detecting CFC levels. Fitted into a hand-held bellows pump, the tube completes the measuring process in under 60 seconds and gives an immediate indication of gas concentration.

Reader Enquiry Service No. 9011

BOOKS AND REPORTS

MARKET MECHANISMS: CHARGING AND SUBSIDIES

*Environmental Resources Limited, 106 Gloucester Place, London, W1H 3DB.
January 1990.*

Environmental Resources Limited has recently published the results of a study of charging and subsidy systems used for pollution control purposes in Germany, France, the Netherlands, Italy, Sweden, Norway, Denmark, Spain, Japan and the UK.

The report, which was commissioned by the Department of Environment, considers both the effectiveness of charging and subsidy schemes in improving environmental conditions and the trends emerging over the past five years. The study shows that with the exception of Germany, there are strong indications that the role of subsidies is being reduced. Some countries have largely discontinued their use — for example, Sweden now only offers subsidy for flue gas treatment, but offered a decade ago a major subsidy programme. Subsidies are generally more focused than five years ago and tend to be related to specific pollutants.

ACID EARTH: THE GLOBAL THREAT OF ACID POLLUTION

Ed. John McCormick. Publisher: Earthscan, 1989. £6.95. ISBN 185383033

Enlarged and revised edition, covering all aspects of global acid pollution in accessible paperback format.

THE MOTOR CAR AND THE ENVIRONMENT:

Volkswagen Services to Education. £15.00.

A teaching pack aimed at 11-14 age range. It covers the technical aspects of motor vehicle pollution control, and contains video, work programme, fact sheets, case studies, database and teachers guide.

THE 1990 HERTZ REPORT

Hertz Leasing and Fleet Management, 1990. £75. ISBN 0951523600

With 50% of all new cars on the road being company cars, the Hertz report aims to explain the impact of impending EC legislation on company fleet costs and performance, recognising that if vehicles are to remain on the road, measures have to be taken to control vehicle pollution. Technical details of pollution control are covered, with comparisons of vehicle performance and cost with and without emission control equipment. The conclusion reached is that the 'cost and performance penalties associated with using a car with emission control is negligible, if it exists at all.'

THE ENGINEER'S CLEAN AIR HANDBOOK

Peter Y. Osborn. Publisher: Butterworths, 1989. £40.00. ISBN 0408033932

This handbook contains practical information on atmospheric contaminants and their control. It covers the chemistry of the atmosphere and its contaminants, air filters and filtration systems, instrumentation for monitoring and control, ventilation and health. It aims to provide a reference source for building services engineers and designers and manufacturers of control equipment.

ENVIRONMENTAL IMPACTS OF HAZARDOUS WASTE TREATMENT STORAGE AND DISPOSAL FACILITIES

R. Salcedo, F. Cross, R. Chrisinon. Publisher: Technomic, 1989. S Fr 108 ISBN 0877626278

The book aims to encompass all the environmental concerns regarding hazardous waste treatment and disposal facilities, from the origins and types of waste, methods of disposal to understanding public attitudes, environmental impact assessment and liability.

ENVIRONMENTAL TECHNOLOGY, ASSESSMENT AND POLICY

Ed. R.K. Jain, A. Clark 1989. John Wiley and Sons. £39.95. ISBN 0745806872

A collection of selected papers from a workshop in Cambridge in 1985, aimed at assessing emerging technologies and research efforts dealing with environmental policies in Western Europe and the United States. Areas covered are air pollution control, water treatment, wastewater treatment, hazardous/toxic waste and environmental policy regulations.

HOTHOUSE EARTH — THE GREENHOUSE EFFECT AND GAIA

John Gribbin, 1989. Bantam Press. £14.95. ISBN 0593017951

Taking the 'Changing Atmosphere' Conference in Toronto in May 1988 as the point at which governments began to take global warming seriously, Gribbin sets out the evidence for global warming against the historical background of natural climatic processes. He explains how climatic cycles work, providing an introduction to the concept of global warming and concludes with a discussion of possible problems and solutions.

CITIES AND AUTOMOBILE DEPENDENCE: An international source book

Peter Newman and Jeffery Kenworthy 1989. Gower Technical. £45. ISBN 0566070505

A compilation of statistics on population, transport and land use covering 32 cities around the world, which provide the basis for a study of urban transport needs and policies.

CONSERVING THE ATMOSPHERE

John Baines, Publisher: Wayland 1989. £7.50. ISBN 1852106964

Part of the 'Conserving Our World' Series aimed at upper junior/lower secondary schools. Starting with a general introduction on the atmosphere, the book covers all forms of air pollution. Well illustrated with photographs and diagrams, it also contains a useful glossary and reference list.

THE YOUNG PERSONS GUIDE TO SAVING THE PLANET

Debbie Silver and Bernadette Valley, Virago 1990. £2.99. ISBN 185381143

For the novice planet saver, an A—Z of environmental nasties with advice on action the individual can take on everything from Additives to Zoos. Some of the organisations noted in the text (notably NSCA) are not included in the appendix, and the authors do give some rather strange advice — such as hanging dry cleaned clothes outside for the chemicals to disperse (where to, we wonder), and writing limericks to avoid getting too depressed about the state of the planet. In spite of this, it provides a broad-based introduction to 'green' issues.

THE GLOBAL ENVIRONMENT MOVEMENT

John McCormick, 1989. Belhaven Press. £27.50 ISBN 1852930861

The book charts the rise of the global environment movement from its roots in the nature-lovers of Victorian times to the massive international social and political movement we have today. It concludes with an assessment of the prospects for international co-operation in the future and significance of the current environmental movement.

FUTURE EVENTS

22 MAY — ONE DAY SEMINAR: ENVIRONMENTAL PROTECTION

Aimed at regulators, industry and local government, this seminar will look at the significance of the *Environmental Protection Bill*, and the move towards a system of integrated pollution control away from the piecemeal regulation developed over the years.

Venue: University of Leicester.

Details: Mrs. Kate Penny, Continuing Education Unit, University of Leicester. Telephone: 0533 522464. Fax: 0533 522200.

24-28 MAY — THE FIRST GREEN CONSUMER EXHIBITION

Multi-faceted exhibition bringing together a variety of those involved in the environment, including academics, manufacturers and retailers. Also lecture programme covering local, national and global effects of consumerism.

Venue: Old Halls, The Royal Horticultural Halls, London SW1.

Details: New Life Designs, Arnica House, 170 Campden Hill Road, London W8 7AS. Telephone: 01 938 3788.

5-8 JUNE — 5TH WORLD FILTRATION CONGRESS AND EXHIBITION

The major theme of the Congress is separation by filtration, giving due attention to the increasingly significant role of membranes. Emphasis will be given to the adaptation of processes to market requirements, energy saving and quality of life.

Venue: Palais des Congres Acropolis, Nice, France.

Details: Corrine Le Roux, SFF, 21 av. de la Div. Leclerc, F 94230 Cachan, France. Telephone: (+33 1) 46 65 18 34. Fax (+33 1) 46 63 26 00.

6 JUNE — WORKSHOP: WASTE MINIMISATION — ACHIEVING THE DUTY OF CARE.

The *Environmental Protection Bill* introduces a statutory duty of care with regard to waste disposal. The workshop will focus on developments of novel technological approaches to industrial production processes which are inherently pollution free or which minimise the problem.

Venue: The Update Centre, Sheffield University.

Details: Short Course Officer, Centre for Continuing Vocational Education, The University of Sheffield, 65 Wilkinson Street, Sheffield S10 2GJ. Telephone: 0742 768653.

20-24 JUNE — EXHIBITION: THE GREEN SHOW

Exhibitors include Tesco, Rover, MAFF, Departments of Energy and Environment, WWF and Centre for Alternative Technology.

Venue: National Exhibition Centre, Birmingham.

Details: Jan Brookes, HB Johnson Woodier, 95 Hagley Road, Edgbaston, Birmingham B16 8LA. Telephone: 021 454 9390. Fax: 021 454 9935.

21-23 SEPTEMBER — 2 DAY CONFERENCE: THE CHANGING ENVIRONMENT.

The conference will offer an assessment of environmental issues facing the world today. Experts from Oxford University's Environmental Change Unit will present contemporary reviews of key topics and will identify problems, implications and proposals for action.

Venue: Somerville College, Oxford University.

Details: Ms. Anna Morris, Administrator, Continuing Professional Development Unit, Department of External Studies, Univeristy of Oxford, Rewley House, 1 Wellington Square, Oxford OX1 2JA. Telephone: 0865 270373.

15-18 OCTOBER — 57TH CLEAN AIR CONFERENCE

The provisional programme includes sessions on acid rain, energy and the environment, assessing the environment, toxics and nuisance and the new powers for local authorities under the *Environmental Protection Bill*.

Venue: Hewison Hall, The Brighton Centre.

Details: Peter Mitchell, NSCA, 136 North Street, Brighton BN1 1RG. Telephone: 0273 26313. Fax: 0273 735802.

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EDITORIAL

BAT OR BATNEEC

The *Environmental Protection Bill* introduces the concept of BATNEEC — Best Available Techniques Not Entailing Excessive Costs — to minimise releases of pollution to air for Scheduled Processes controlled by local authorities (Part B) and to all media for Scheduled Processes controlled by HMIP (Part A).

There is growing concern that the guidance notes now being prepared by HMIP for Part A and B processes will describe the Best Available Techniques (BAT), but fail to evaluate what constitutes Excessive Costs (NEEC). What had originally been referred to as BATNEEC Notes will in reality only be BAT Notes. This gives rise to the danger that the interpretation of NEEC may vary across the country — precisely the criticism which was levelled at the old BPM (Best Practicable Means) approach. Even if there is widespread agreement in the UK about what constitutes BAT, it may not be enforced uniformly throughout the European Community not least because the UK is using the word *Techniques*, rather than the more restrictive EC formulation *Technology*.

The Department of Environment circular of 26 April on the meaning of BATNEEC states: "...the process of arriving at BATNEEC must be open and explicit. It is proposed to convey this information through the medium of published guidance to HMIP Inspectors and to local authorities on the application of integrated pollution regulation of air pollution control (including BATNEEC factors) for classes of process." However the circular also makes it clear that "...in each individual case the Chief Inspector or the local authority must decide what is BATNEEC and translate it into requirements in the condition of the authorisation."

The first tranche of Part B notes — likely to be known as "Process Guidance Notes" have been produced on schedule by the HMIP Local Authority Unit and will shortly be circulated for official consultation by the DOE.

NSCA believes that for new processes only minor modifications to BAT on financial grounds should be permitted. When applied to existing processes, excessive cost should be defined more positively. Otherwise some industries may be allowed to continue to cause more pollution than their competitors by citing a range of mitigating factors. Such special pleading gives rise to inconsistent enforcement of standards and is no longer acceptable. Comparable industries must meet the same standards of pollution control across the country.



nsca

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Monday 15 October to
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**If you are involved in pollution control you can't afford to miss the
1990 NSCA Clean Air Conference and Exhibition.**

This year the annual gathering of the UK pollution professionals starts with an international theme. The liberalisation of Eastern Europe has brought a growing understanding of the appalling pollution problems which these countries face, and of the implications for air pollution across Europe. The Conference will reassess the Acid Rain debate and discuss how we in the West can best assist the development of effective pollution control in the East.

Alongside the usual specialist papers on pollution and noise control there will also be a session on environmental auditing and risk assessment, and an evaluation of the impact of the forthcoming Environmental Protection Act on local authorities.

Last year's Conference received widespread media coverage and delegates agreed that it was one of the best ever. As environmental matters and pollution control problems grow ever more complex the NSCA Conference offers you an opportunity to keep right up to date with all the important issues.

We look forward to welcoming you to Brighton.

For a copy of the Conference Brochure please contact NSCA
Telephone: 0273 26313 Fax: 0273 735802

NSCA NEWS AND VIEWS

CONTROLLING NUISANCE FROM ROAD VEHICLES

A Discussion Paper from NSCA

Introduction

NSCA has long held the view that nuisance from road vehicles is not adequately controlled in the UK. Recent campaigns on diesel smoke and motorcycle noise have underlined the need for more effective controls in this area. In March this year NSCA Secretary General John Langston visited the Tenth International Clean Air Conference of the Clean Air Society of Australia and New Zealand (CASANZ) and brought back details of a new scheme now operating successfully in the State of Victoria. This prompted a discussion by NSCA's Technical and Parliamentary and local Government Committees about the most appropriate means of controlling such nuisance in the UK. The result is this discussion paper; NSCA would be most interested to receive any comments from readers on the subject.

Clean Air would like to acknowledge the assistance of Greg Howarth of the State of Victoria Environmental Protection Authority in the preparation of this article.

Nuisance from Road Vehicles

Whilst emission standards for new vehicles are improving, once vehicles are on the road there is inadequate control of nuisance from smoke and noise. At present this is a grey area, falling between the police, environmental health officers and the Department of Transport Vehicle Inspectorate.

The police will only prosecute smoky vehicles under the Construction and Use Regulations if the amount of smoke produced is a road safety hazard. In letters to NSCA, both the Home Office and Association of Chief Police Officers have said that the control of general smoke pollution from road vehicles should be the remit of environmental health departments. However local authorities have no powers to control emissions from road vehicles.

Noisy vehicles — especially motorcycles — are also a considerable source of nuisance. However the police appear reluctant to enforce controls without an agreed method of measuring noise levels which will stand up in court.

NSCA proposed an amendment to the *Environmental Protection Bill* to give local authorities, acting in collaboration with the police (who alone have powers to stop mov-

ing vehicles), powers to control motor vehicles under nuisance legislation. This was rejected at Committee stage — partly because sympathetic MPs tried to expand the concept to include aircraft.

As yet there is no consensus in the UK about the most effective way of dealing with motor vehicle nuisance. In many other countries, police and local environmental control agencies co-operate in spotting defective vehicles, usually on the basis of visual assessment or simple technical measurement. They issue vehicle rectification tickets which require the vehicle to be checked and certified by a garage. Such a system could be introduced in the UK.

Annual MOT Testing

NSCA has pressed for the inclusion of vehicle exhaust emission testing at the annual MOT test, and welcomes the recent announcement from the Department of Transport that such tests will indeed be developed.

Roadside Tests

There are already precedents for co-operation between police forces and environmental health departments in this area. The experiments involving the Derbyshire Constabulary and local EHOs in measuring motorcycle noise have proved very effective, whilst trading standards officers already work with police in checking axle weights on HGVs. It has been suggested that EHOs might be made “police agents” for noise testing vehicles under the Construction and Use Regulations, but in such circumstances a police officer would probably still have to be present. This concept could perhaps be extended to smoke checks if a simple method of measurement could be agreed.

Spotter Programmes: Experience in Australia

One possible model for the UK is the successful system employed in the State of Victoria, Australia. The Environmental Protection Authority of Victoria has developed a wide ranging vehicle “spotting” programme for smoke, noise or tampering with emission controls. Vehicles can also be required to be presented for inspections, measurements or tests at officially designated test sites where necessary. EPA staff also visit used vehicle dealers and carry out field tests and inspections to check that dealers are selling vehicles that comply with environmental requirements. Enforcement is carried out by EPA staff with the co-operation of the police and vehicle registering authority and, in the case of vehicle dealers, with the Ministry of Consumer Affairs. Punitive action ranges from a simple courtesy letter through “on the spot” fines to court prosecution.

The EPA has a special Motor Vehicles Branch which runs a programme for spotting smoky and noisy vehicles. It is based on a simple subjective assessment of nuisance by trained staff using spotter cards — see example below. Both EPA staff and police use the cards for reporting what they consider to be excessively noisy or smoky vehicles. For instance, any vehicle seen emitting visible smoke for more than ten seconds is “spotted”.

The cards are collated by the EPA which has access to the main vehicle registration computer. They write to the registered owner of the vehicle advising them that the vehicle has been assessed as a nuisance, and requiring them to have it checked at an approved testing station within a month. The satisfactory reply rate is about 95 per cent. "For the cost of a stamp it is a very cost effective program", comments Greg Howarth of the Victoria EPA. Legal action is taken against failure to reply or unsatisfactory replies.

More radically, the EPA conducts a "Smoky Vehicle Public Awareness Program" in conjunction with its annual Clean Air Campaign. This is separate and distinct from the regular spotting programme. During the campaign, members of the public are encouraged to telephone a special number to report vehicles which they consider to be emitting excess smoke. They must give their name and address, although this remains confidential, as a deterrent to vindictive reporting. Again, using the vehicle registration computer the EPA writes a "friendly" letter to the owner asking them to check their vehicle. No further action is taken, and no follow up is conducted. During the first programme 2,500 reports were received in two months. Greg Howarth notes the following:

"1. It was impossible to "turn off" the reporting of vehicles by the public. Despite repeated messages to the media that the campaign had finished, telephone reports are still coming in. The campaign seemed to have answered a public need.

2. There were very few complaints of allegedly incorrect spottings. We received approximately 100 telephone calls directly as a result of the letter. All but six were to thank us for drawing attention to their vehicle's smoke. . . only from that half dozen was there any sort of aggressive response."

The success of the Victoria EPA spotter programme is not in doubt, but it cannot be directly translated to the UK situation:

1. There is no legislative framework.
2. There is no consensus that local authority EHOs should be involved in this sort of work, although there is a clear link both to trading standards and pollution control activities. An alternative would be to make the system the responsibility of the police or Dtp vehicle inspectors, but these bodies might not be able to prioritise such work and may be less responsive to local demands.
3. Access to data on the vehicle registration computer may have implications for civil liberties.
4. The additional option of involving the public in reporting requires separate consideration.

Nevertheless, it is clear that the existing framework for controlling nuisance from road vehicles is inadequate. The three "contenders" for overall responsibility are EHOs, police and Dtp Vehicle Inspectors. We should agree firstly which authority, or combination of authorities should be primarily responsible for nuisance from road vehicles; secondly what additional powers if any they require; thirdly what extra resources they will need to undertake the task effectively.

Example of Spotter Card

ENVIRONMENT PROTECTION AUTHORITY
MOTOR VEHICLE REPORT
NOISE · SMOKE · TAMPERING

Name & Number								
Station								
Date	/		/					
Time			:					
Road and Suburb								
Nearest Cross Street								
Approx. Dir. of Travel	N	NE	E	SE	S	SW	W	NW
Registration Number								
Make and Model								
Body Type					Colour			

Drivers Name and Address (if known;).....
.....

Vehicles exhaust considered **noisy** ☐ or **faulty** ☐

OR,

Vehicle emitted **visible smoke** continuously for ☐ seconds

Tailpipe was horizontal ☐ or Vertical ☐

Vehicle; stationary ☐; moving on level ☐ upgrade ☐ downgrade ☐

OR,

Pollution controls defective, missing or incorrect ☐

Please list faults on reverse side of form if known.

Please forward to: Environment Protection Authority
P.O. Box 315
EAST MELBOURNE 3002

(Reverse side of card)

Item of pollution control equipment which is incorrect

- Carbon canister missing/not connected
- Air cleaner not original/modified
- Carburettor changed Holley/Weber/other
- Vacuum hoses cut/blocked/not correctly connected
- Unleaded vehicle using super grade leaded petrol

Other please specify
.....
.....
.....
.....

NSCA would be very pleased to provide a forum to establish the most effective solution to this question, and hope that the forthcoming White Paper on the Environment might address the matter.

Pilot Programmes in the UK

From the viewpoint of public involvement, a hotline set up recently by *Green Magazine* in support of NSCA’s diesel campaign attracted thousands of calls from members of the public reporting smoky vehicles. Derby City Council is now proposing a novel scheme which could set the pattern for other local authorities. A hotline will be available for the public to report smoking vehicles to the Environmental Health Department. The Department will log the number of the vehicle concerned and two actions may then be taken.

Firstly, a “friendly” standard letter will be sent to the owner of the vehicle. This requires the co-operation of the police, who alone have access to the Swansea DVLC vehicle registration computer. In this case, the Department prepares a standard letter in a prepaid envelope with the vehicle registration number typed on the outside. This is passed to the Derby Police, who look up the registration number on the DVLC computer and then address the letter to the owner of the vehicle.

Secondly, in the case of HGVs or public service vehicles, where the logging of registration numbers by the Department shows a persistent offender, the office of the local Dtp Vehicle Inspectorate will be contacted. They have undertaken to look at any vehicles which attract complaints, and as an ultimate sanction have the power to modify the operator’s licence where appropriate. Derby City Council has thus taken a lead in acting against vehicle nuisance, and secured the co-operation of the local police and vehicle inspectors in its efforts. We will await the outcome of the experiment with interest.

CLEAN CARS — HOW TO CHOOSE ONE

The competing claims of diesel and unleaded petrol have led to considerable public confusion about “environmentally friendly” motoring. However, NSCA’s latest report published in July aims to clear the air. *Clean Cars — How to Choose One* is aimed at motorists and fleet operators who wish to take environmental considerations into account when buying a new car. Among the findings are that

- Diesel cars are generally less damaging to the environment than current petrol-engined cars, with low emissions of most pollutants and greater energy efficiency. However they get a black mark for smoke and smell.
- Petrol engined cars fitted with catalytic convertors will also have low emissions of most pollutants but may risk a slight fuel consumption penalty.

Many vehicle fleet operators are also keen to demonstrate “green” credentials, but may balk at the additional costs of catalyst-equipped petrol cars. Under EEC regulations catalysts will be required by 1993, but as yet there are relatively few catalyst-equipped small cars or vans on the market. The factors outlined above will be of particular importance in choosing new fleet vehicles. To maximise the effectiveness of a green policy, however, the report points out that other initiatives could be of equal importance.

The report suggests that company policy should be reviewed to encourage the use of smaller cars and discourage unnecessary commuting by car. Company car “packages”, involving incen-

tives and subsidies for cars, petrol and parking could be switched in favour of more enlightened initiatives such as free/subsidised public transport travel passes, incentives for car sharing and improved facilities for cycle use.

Finally, the report emphasises that there is no such thing as a truly clean car. In making an informed choice about car purchase and use our impact on the environment can only be minimised — never eliminated!

AUDIBLE BIRD SCARERS

In giving a general welcome to the second draft of the Department of Environment’s Code of Practice on Noise from Audible Bird Scarers. NSCA has made the following comments:

Scarers at New Locations (s. 6.4-6.6)

NSCA recommends that the differing requirements for the notification of the local authority of the use of an audible bird scarer, depending upon the distance between the audible scarer and the nearest noise sensitive premises be amended, as it cannot be assumed that scarers situated more than one kilometre from a noise sensitive premises will not cause nuisance.

As monitoring large numbers of audible scarers will prove impossible for some rural local authorities, it would appear simpler if there was a requirement for the prior notification of the local authority of the installation of all audible scarers. It would then be up to local environmental health officers to consider each case on its merits, in relation to the potential for noise nuisance.

Section 1.2 of the Code requires that the use of audible bird scarers

should only be considered where other non-killing methods not relying on noise have been tried and have proved ineffective. It is recommended that there should be a requirement to advise the local environmental health officer in writing, of those other methods which have been tried, and of the reasons why they have proved to be ineffective.

Times of Operation (s. 7.1)

This section requires that audible bird scarers should only be used between sunrise and sunset and not normally before 6.15 a.m. There is no mention of any time in the evening beyond which the scarer should not be used. It is recommended that consideration be given to specifying such a time, particularly since in the northern parts of Scotland the sun sets very late in summertime. A time of 10.00 p.m. is considered appropriate. Where complaints are received it is considered that it would never normally be acceptable for scarers to be operated before 6.15 a.m., and any time in the evening which may be specified.

Other Considerations (s. 9)

NSCA recommends that where multiple scarers (s. 9.2) are provided the noise could be additive. It is recommended that there be a restriction placed on the number of scarers within a particular specified area.

Audible scarers are a particular source of anxiety to members of the public walking in the countryside. Because of the very loud but intermittent nature of the noise produced, approaching a device whilst anticipating a sudden explosion can be an unpleasant experience. Under no cir-

cumstances should audible scarers be placed (s. 9.6) within 100 m of a public road, bridleway or footpath. Warning signs should be placed at the entrances to any fields crossed by a public right of way, where an audible scarer is in use.

Once finalised, the Code will be approved by the Secretary of State under section 71 of the *Control of Pollution Act, 1974*.

WASTE: DUTY OF CARE

NSCA has submitted comments to the Department of Environment on its draft Code of Practice aimed at curbing the illegal disposal of waste.

In welcoming the concept of a Duty of Care in waste disposal matters, NSCA commented that properly applied it could serve as a safety net to protect environmental quality in situations where, despite compliance with the letter of the law, threat or hazard may still exist. NSCA suggests that the concept could be more widely applied in the context of environmental regulation. The difficulty lies in legislating to enforce the consistent application of such a concept; the definitions of "duty" and "care" can both be widely interpreted.

The proposed Code of Practice aims to provide practical guidance on how holders of waste are expected to discharge what will be a statutory duty under the forthcoming *Environmental Protection Act*: NSCA considers that the proposed framework is workable, but runs the risk of diluting the effectiveness of the duty of care by passing the duty along a chain of responsibility to subsequent handlers.

Unless a “cradle to grave” duty is placed on the creator of waste the system will fail to guarantee legal disposal. The requirement in the existing draft for waste holders simply to “take account of any evidence suggesting that illegal disposal might ensue” and reliance on a waste holder who “suspects, knows or foresees” illegal disposal does not give due weight to the responsibility of waste creators. Particularly where large waste producers are concerned, it is reasonable to expect a requirement to make positive checks on the disposal of their wastes. NSCA regrets that the DOE appears to have retrenched on its earlier view that such a requirement could be placed on large producers.

STRAW AND STUBBLE BURNING

In its current draft form, the *Environmental Protection Bill* gives powers of exemption from the proposed ban on the burning of crop residues. NSCA wrote to the Agriculture Minister seeking clarification on the circumstances in which exemptions will be granted; in reply we were informed that there will be permanent exemptions on burning for research or training purposes and for crops where practical alternatives do not currently exist — for example linseed oil. These are accepted as being unavoidable, however, no criteria have yet been established for determining when temporary exemptions will apply. This raises some cause for concern, as it is when alternative methods become “impractical” — such as when heavy soils become too wet for burning that the exemption should apply. The regions with heavy soils are precisely those where stubble burning is a problem.

However, as the ban will not be enforced until 1993 there is time for a system to be agreed to satisfy both farmers and environmentalists.

Meanwhile, in response to increasing concern about the problem, the NFU, following consultation with NSCA and other bodies has issued a revised code on crop residue burning. It is more specific in its recommendations than the 1986 code, emphasising the importance of avoiding nuisance by inconsiderate burning, reducing the time limit for ash incorporation and increasing firebreak requirements; this will hopefully alleviate any problems in the remaining burning seasons. NSCA will, however, continue to monitor the situation closely and will be carrying out its annual survey of local authorities to establish whether they have experienced any problems with the 1990 harvest.

RAILWAY NOISE STANDARD

The Minister of State for Transport has set up a Committee to recommend to the Secretary of State for Transport a national noise insulation standard (or standards) for the operation of new railway lines which equitably relates to the standard set by regulation for new highways. The aim is to arrive at a standard or standards at which the duty to offer noise insulation will be triggered and to set a trigger at a level which will ensure that there is parity of treatment between those who live near new railways and those who live near new roads.

In a submission to the Committee, NSCA noted that noise from railways is likely to increase in the future for a number of reasons: increased traffic

and the development of new rail links for the Channel Tunnel; the development of new light rail systems in some urban areas; and general increased use of existing routes.

NSCA drew attention to recent studies by Technica for Kent County Council, and by the London Boroughs Consortium in collaboration with London Scientific Services which have recommended noise standards. Both studies reach very similar conclusions about appropriate standards. We support the analysis and conclusions of those studies, in particular the importance of using a range of L_{Aeq} standards which reflect the varying sensitivity of people to noise during daytime, evening and night, rather than a single 24 hour L_{Aeq} value.

The single 70 L_{Aeq} guideline proposed by British Rail for the installation of sound insulation appears to be considerably higher than comparable standards already accepted in Europe.

We would endorse the standards proposed by the two studies mentioned above:

Day	L_{Aeq}	65	dB(A)
Evening	L_{Aeq}	60	dB(A)
Night	L_{Aeq}	55	dB(A)

It should be noted that even these standards are less stringent than current Dutch standards.

As with road schemes, policy for new routes and established routes is inconsistent. It is hard to understand why insulation is considered appropriate for new schemes at a given noise level, but not when noise rises to a similar level on existing routes due to increasing traffic. We would endorse the view that, where predicted noise levels rise by 3 dB(A) to levels exceeding those shown above, insulation should be required.

The Committee is expected to report to the Minister in September.

DIVISIONAL NEWS

EAST MIDLANDS/ EASTERN DIVISIONS

Any resident of the Counties or Shires of Cambridge, Derby, Leicester, Lincoln, Nottingham and Northampton who is also a member of the East Midlands Division will possibly have noticed that the Honorary Secretary/Treasurer has managed to complete his first year of office without major catastrophe. He has also managed to balance the Division's Accounts and for both these achievements is duly thankful.

The Division has had a fairly active year and in addition to the Autumn meeting reported in last Autumn's *Clean Air*, there have been two further Divisional Meetings. The first of these was at the British Coal Corporation Scientific Services Laboratory at Bretby, where we were able to see something of the services that the Laboratories can offer the Corporation, Industry and the Local Authorities.

The second meeting, the AGM took place in Peterborough and was notable

for the presentation by Mr Storer of South Derbyshire District Council on the Control of Hydrocarbon Emissions from the Car Industry. This was of particular interest in view of the new Toyota Plant which is being built in Derbyshire.

The planned Autumn meeting of the Division represents something of a departure from tradition as it will deal with the control of water pollution. However, this is fully in keeping with the new title of the Society and is expected to be of great interest to our members. Later this year it is also hoped to arrange a Workshop meeting at which members of the Division will be able to discuss any problems associated with the implementation of the *Environmental Protection Act*.

LONDON/SOUTH EAST AND CENTRAL SOUTHERN

The 35th AGM of the Divisions was held on 26 June at Sudbury House courtesy of National Power. Mrs. G.E. Naylor was re-elected Chairman, Mr. P. Cooney, Deputy Chairman, Mr. J. Beagle, Hon. Secretary and Mr. B. Nagle, Hon. Auditor.

In her annual report, the Chairman noted an increase in Divisional Membership from 189 to 201 during the year. During the year visits had been made to the Water Research Laboratory (Bucks) and to Wimpey's Environmental Services Ltd (Middlesex). During 1991, it was noted the Division hope to arrange a Clean Air Exhibition.

It has also been agreed to recommend that the two Divisions be formally amalgamated and renamed the South East Division. A new constitution will be drawn up for presentation to the next AGM.

After the AGM the meeting was addressed by Mr. David Jolly, Principal Inspector at HMIP on the topic of Hazardous Waste Control and the forthcoming *Environmental Protection Act*; he said that the task of implementing the new legislation and the regulations would present a challenge to the Inspectorate local authorities, and all the other parties involved in waste disposal.

NORTHERN DIVISION

The Spring meeting of the Northern Division was held at ICI's Wilton Headquarters and was attended by 31 members.

After the formal meeting various members of ICI gave presentations on their nitric oxide abatement project. This began with an interesting discourse on the acquisition and development of the site and was followed by a presentation by Mr. R. Bibby on the development of the NO_x abatement project when he referred to the orange plume which was characteristic of the emissions from the plant. Following a tour of the site, further details were given on the development of the project and about how the decision was made to proceed with the plant, the various processes by which abatement could be achieved and the steps which ICI had undertaken in deciding on the appropriate control. There was also a detailed account of how the project was ordered and constructed and how the emission limit of 200 ppm, which had been specified, had been achieved.

NORTHERN IRELAND

On 14 June the Division promoted a public lecture on global warming at the University of Ulster, Jordanstown, with presentations being made by the Socie-

ty's President Sir John Mason and Chairman of Council Dr. F. Shephard.

Councillor Mrs D. Dunlop, Chairman of the Northern Ireland Division welcomed the speakers and introduced Dr. Shephard who made the first presentation. He outlined the role of the Society, its development in terms of concerns for the local, regional, national and international aspects of pollution and environmental controls. He further outlined the current issues with which the Society is dealing and highlighted the diversity of pollution topics which eventually led to the Society adding to its name "Environmental Protection".

Councillor Dunlop then introduced Sir John Mason, President of the Society, who explained the phenomenon referred to as the "Greenhouse Effect" and indicated the necessity for this effect in order to sustain life on earth. He further explained how our climate system is driven and how heat is absorbed, reflected and re-radiated back to the earth. Aspects of the various greenhouse gases were then presented and their effect on our system explained. Sir John then went on to discuss the types of measurements that are made around the world, the use of modelling and computers to predict changes and the effects of such change.

Following Sir John's presentation there was a wide-ranging question and answer session which included the use of alternative energy sources and the impact of Eastern European and third world countries on the environment.

The Division was most pleased with the response to the lecture, which was attended by 100 people from a wide range of disciplines. Thanks are also due to the Northern Ireland Coal Advisory Ser-

vices for sponsoring the lecture and in particular to Mr. Alan Jeffers and Mr. Philip Dawson. The Division is now preparing a one day seminar on Air Pollution and Noise to be held on 27 September. A provisional programme has been drawn up and details will be circularised during the July/August period.

SCOTTISH DIVISION

At its meeting on 7 June, the Executive Committee of the Scottish Division agreed a programme of seminars for the rest of 1990. On 23 August a seminar looking at the problems of air pollution, with an emphasis on smoke control will be held. On 20 November environmental impact assessment, environmental audits and acid rain will be the topics for the one day seminar.

YORKSHIRE & HUMBERSIDE

Twenty-five members attended a joint meeting with the Yorkshire and Humberside Pollution Advisory Council at the offices of National Power, Harrogate on 23 May.

A Divisional Council meeting was held during the morning, which included a report from Mr. R. Crosby, Rotherham Metropolitan Borough Council, on the implementation and operation of a solvent recovery plant in the Rotherham area. There was also a presentation by Mr. A. Windsor, Regional Head of Her Majesty's Inspectorate of Pollution for the Northern Region, on the changes in structure of HMIP.

In the afternoon presentations were made by National Power on low NOx burners and on sulphur dioxide abatement, and Mr. Windsor reported on the proposed new clean air legislation.

REPORTS

VEHICLE EMISSIONS

Dr. Martin L. Williams

**Head, Air Pollution Division
Warren Spring Laboratory**

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This paper was first presented at the NSCA's 1990 Workshop, Transportation and the Local Environment.

1. Introduction

In order to make estimates of future air pollution emissions from traffic it is essential to know, amongst other things, the emission patterns of future vehicle technologies in as much detail as possible. It is then possible, using forecast increases in traffic activity, to project emissions into the future. This paper outlines some of the results of measurement studies at Warren Spring Laboratory which have been designed to address these issues. The application of the results of these measurements to forecasting emissions is briefly discussed. The emphasis is on passenger cars and in particular measurements on existing technology cars and vehicles equipped with three-way catalysts (TWC).

2. On the Road Measurements of Pollutant Emissions

The results described in this section are taken from a recent report (Dunne, 1990) which summarises the results to date of WSL's measurements of emissions from so-called "low emissions" technology vehicles. These comprised three-way catalyst, diesel and lean burn engines (with and without oxidation catalyst) vehicles. The reader is referred to the full report for a more detailed discussion of the emissions of these vehicles.

The measurements were all made with the vehicles in an "as-received" condition without any special pre-treatment. The WSL miniature constant-volume sampler (mini-CVS) system was used to provide emissions data over the full speed range of each vehicle (up to the legal limit) from a series of road drives in conditions ranging from low speed (approx. 20 kph) urban drives up to motorway drives at 113 kph. Standard UN-ECE (UN Economic Commission for Europe) Regulation 15 tests (both hot and cold start) were also carried out; for the catalyst vehicles Regulation 15

tests including the recently agreed higher-speed extra-urban driving cycle (EUDC) were also performed, giving an overall average speed of 57 kph.

In all six TWC vehicles were tested, their engine sizes ranging from 1117 cc to 1993 cc with a mean of 1716 cc; their weights ranged from 907 kg to 1361 kg with a mean of 1183 kg. To make as good a comparison as practicable, a sub sample of nine Regulation 15-04 cars was chosen from a larger sample studied by WSL (Simmonds, 1989). The models were not always the same as those in the TWC set; the range and mean values of engine size and weights however were very similar to those of the TWC vehicles. Engine sizes for the R15-04 cars ranged from 1392 cc to 2197 cc with a mean of 1652 cc; weights ranged from 907 kg to 1361 kg with a mean of 1069 kg. On average therefore there was little difference (approx. 4 per cent) in the engine sizes of the two sets, but the TWC vehicles were 10 per cent heavier. This should be borne in mind when comparing the results from the two sets, particularly those for fuel consumption. A series of six indirect injection (IDI) diesel engine cars were also tested and compared with the R15-04 and TWC sets. These diesel vehicles ranged from 1598 cc to 2304 cc with a mean of 1870 cc and from 895 kg to 1245 kg with a mean of 1048 kg.

The results of the measurements for carbon monoxide (CO) are shown in Figure 1 from which it is apparent that the TWC and diesel vehicles emit very much less CO than the R15-04 vehicles. (The three points around 20 kph are the cold and hot R15 tests at 18.7 kph with the cold start data displaced laterally for clarity, and the 20 kph urban road drives.) The large variation of CO emissions with speed is apparent with the minimum for the R15-04 vehicles, at about 90 kph (approx. 56 mph), about six times smaller than at 20 kph. The cold start emission from the catalyst vehicles is clearly apparent and at 3.42 g/km is much higher than the emissions during road drives which are in the range 0.21-0.79 g/km. It is interesting to note that the IDI diesel vehicles also display very low emission rates, ranging from 0.91 g/km in the cold start R15 tests to 0.24-0.74 g/km in the road drives. The lower part of Figure 1 shows the percentage differences between the TWC and IDI diesels and the R15-04 cars respectively. Apart from the cold start tests where for the TWC cars the improvement was only approx. 40 per cent, the differences are approx. 90-95 per cent. It should be noted here that all the catalysts tested were relatively new, none having accumulated more than about 10,000 miles.

In terms of percentage reduction from the R15-04 base, the results for total hydrocarbon emissions from the TWC vehicles are very similar to those of CO and will not be discussed further here.

The results for nitrogen oxides (NO_x) are shown in Figure 2. The fundamental principles of the formation of NO_x are immediately apparent from the R15-04 car results. Unlike CO and hydrocarbons which are formed from incomplete combustion and therefore increase sharply with decreasing vehicle speed, NO_x is formed chiefly by oxidising the nitrogen in the air and as such increases with combustion temperature and vehicle speed. (At even higher speeds than those shown, NO_x emissions may even begin to decrease in some vehicles as over-fuelling occurs and combustion temperatures drop.) The NO_x emissions from the R15-04 vehicles increase

from around 1.8-2.5 g/km at 18-20 kph to 3.86 g/km at 113 kph. Emissions from the IDI diesel vehicles are significantly lower ranging from 0.82 g/km for R15 cold starts to 0.38 g/km at 113 kph. Emissions from most of the TWC vehicles (i.e. excluding vehicle C2 — see below) were very low ranging from 0.92 g/km for R15 cold starts to 0.18 g/km at 113 kph. One TWC vehicle (C2) however showed larger NO_x emissions than the rest at levels broadly similar to the IDI diesels but still significantly less than the R15-04 cars. These results are shown separately in Figure 2. The reasons for this are not immediately clear, but a possible cause may be that a problem in the engine management system (which controls the air/fuel ratio at $\lambda = 1$ in normal operation) caused the engine to run lean of stoichiometric so that the catalyst was exposed to a predominantly oxidising environment and was unable to reduce the NO_x completely. This explanation is consistent with the observation that CO and hydrocarbon emissions for this vehicle were low and very similar to the other TWC vehicles. Without measurements on many more in-service TWC vehicles it is not possible to predict how common such problems are likely to be in practice. The percentage reductions in NO_x are also shown in Figure 2. The majority of the TWC vehicles showed emission reductions of approx. 85 per cent at cold start and approx. 95 per cent or more for the road drives. The anomalous TWC vehicle only showed a reduction of approx. 45 per cent on the R15 cold start and approx. 70-85 per cent on the road drives.

As part of the measurement programme, fuel consumptions in all tests were calculated using the so-called carbon balance method whereby the measured CO₂ emission and those of CO and hydrocarbons are converted to an equivalent fuel consumption. The results in Figure 3 show that the TWC vehicles were found to have higher fuel consumptions than the R15-04 cars throughout the speed range. The percentage differences ranged from approx. 9 per cent across most of the speed range in the road drives improving to 3 per cent at the maximum motorway speed. The mean results for the dynamometer tests (Regulation 15 tests) showed a greater penalty of 20 per cent. The reasons for this are not clear and may reflect the small sample size. The fuel consumptions for diesel vehicles (which in litres/100 km are much lower than the 15-04 or TWC vehicles) should be corrected for the higher density of diesel fuel (approx. 12 per cent denser than petrol) to compare carbon (i.e. CO₂) emissions on a mass basis. When this is taken into account the differences in carbon emissions between the R15 vehicles and IDI diesels will be somewhat smaller. This margin may be reduced further if power-to-weight effects are considered in more detail.

It is interesting to note that for R15-04 vehicles the fuel consumption at 90 kph (approx. 56 mph) is 5.4 l/100 km compared with 9.3 l/100 km at 20 kph (approx. 12.5 mph), an improvement of 42 per cent compared with the 20 kph value. A similar relative change occurs in the other vehicles. At 113 kph (70 mph) the R15-04 vehicles consumption degrades again to 6.6 l/100 km, a worsening of 29 per cent compared with the value at 90 kph.

3. Future Trends in Vehicle Emissions

Information of the type discussed in the previous section underpins any attempt at

projecting future emissions from motor vehicles. Emissions from cars were discussed in section 2 but clearly similar information is needed for the other classes of road vehicles and heavy goods vehicles are particularly important here.

The emission versus speed relationships described in section 2 form the basis for the estimation of UK national emissions of air pollutants. The method has been described in some detail in an earlier report (Eggleston, 1987) and will not be repeated here. In essence the method takes the emission/speed curve and folds this onto the frequency distribution of total UK vehicle kilometres driven as a function of speed for each vehicle category. By integrating this product a UK total emission can be obtained. Using this method as a basis for estimating future emissions therefore requires some estimates of future totals of vehicle-kilometres by class of vehicle. These have been published by the Department of Transport in the well-known National Road Traffic Forecasts which show increases of 83 per cent and 142 per cent in total traffic vehicle kilometres between 1988 and 2025 on low and high growth assumptions respectively.

In using this overall method to estimate future emissions further assumptions must be made about the effect of future legislation on emissions and the technology required to meet it, and about the rate at which new technology penetrates the fleet. Moreover the data in section 2 showed the importance of cold start emissions for TWC vehicles and assumptions must be made about typical drive distances required before catalysts "light off". (Measurements at WSL suggest that of the pollutants emitted by TWC vehicles in cold start tests, approx. 80-90 per cent arise from the first cycle of the four cycle R15 test, i.e. in the first 1 km.)

Estimates of future emissions have been made using this overall method (Eggleston, unpublished work, and Fergusson, Holman and Barrett, 1989) and an example of the WSL calculation for NO_x is shown in Figure 4. The broad feature is that in the very short term NO_x emissions continue to increase in line with increasing traffic activity and then decrease significantly as the low emissions TWC vehicles penetrate the fleet — a car lifetime of 10 years was assumed (Eggleston 1987). Eventually at around 2005, the reductions in emissions brought about by the TWC vehicles and those assumed for HGV vehicles, begin to be outweighed by the increases in vehicle kilometres and UK NO_x emissions begin to increase again in line with traffic activity. The role of HGVs is particularly important here and by 2010 emissions from these vehicles are estimated to make the largest single contribution to road traffic NO_x emissions.

Estimates of future emissions of CO₂ are shown in Figure 5. No attempt has been made in this plot to incorporate any improvements in fuel efficiency which may occur in future vehicles; neither has any allowance been made for any possible decrease in fuel efficiency associated with the use of TWC vehicles. The plot is simply a calculation based on current fuel efficiencies and the traffic forecasts, presented in this way simply to illustrate the scale of the possible CO₂ increase if no further improvements in fuel efficiency or any other measures to reduce CO₂ emissions occur. By 2010, on this basis, increases of 25 per cent on the 1989 base are calculated in the low and high growth scenarios.

4. Summary and Conclusions

This paper has discussed recent measurements of air pollutant emissions from in-service cars in the UK, in particular making comparisons between current technology cars (ECE Regulation 15-04), three way catalyst equipped vehicles and diesel cars. It was shown that for the so-called regulated pollutants, carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxides (NO_x), the use of catalysts should lead to very substantial (approx. 85-95 per cent) reductions in emissions during normal running. Emission reductions during cold starts before the catalysts had warmed up were found to be smaller. Overall consumption in the catalyst cars tested was found to be approx. 9 per cent worse than for Regulation 15-04 over most of the speed range and approx. 3 per cent worse at motorway speeds.

Data of the type discussed in the previous paragraph are used to underpin future forecasts of air pollution emissions. Preliminary estimates of future NO_x emissions based on the Department of Transport traffic forecasts suggest that emissions from road traffic will increase to a peak in 1991/1992 and will decrease substantially to a minimum in 2006/2007 when emissions will begin to increase again as traffic activity continues to increase. Carbon dioxide emissions from road transport in future years are also estimated to increase. The extent of the increase would be mitigated by improvements in fuel efficiency but, to give an impression of the scale of possible increases without any such improvement, increases in road traffic CO₂ emissions in 2010 of 25 per cent and 60 per cent on the 1989 base are estimated on Department of Transport traffic forecasts.

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FIGURE 1. CO EMISSIONS

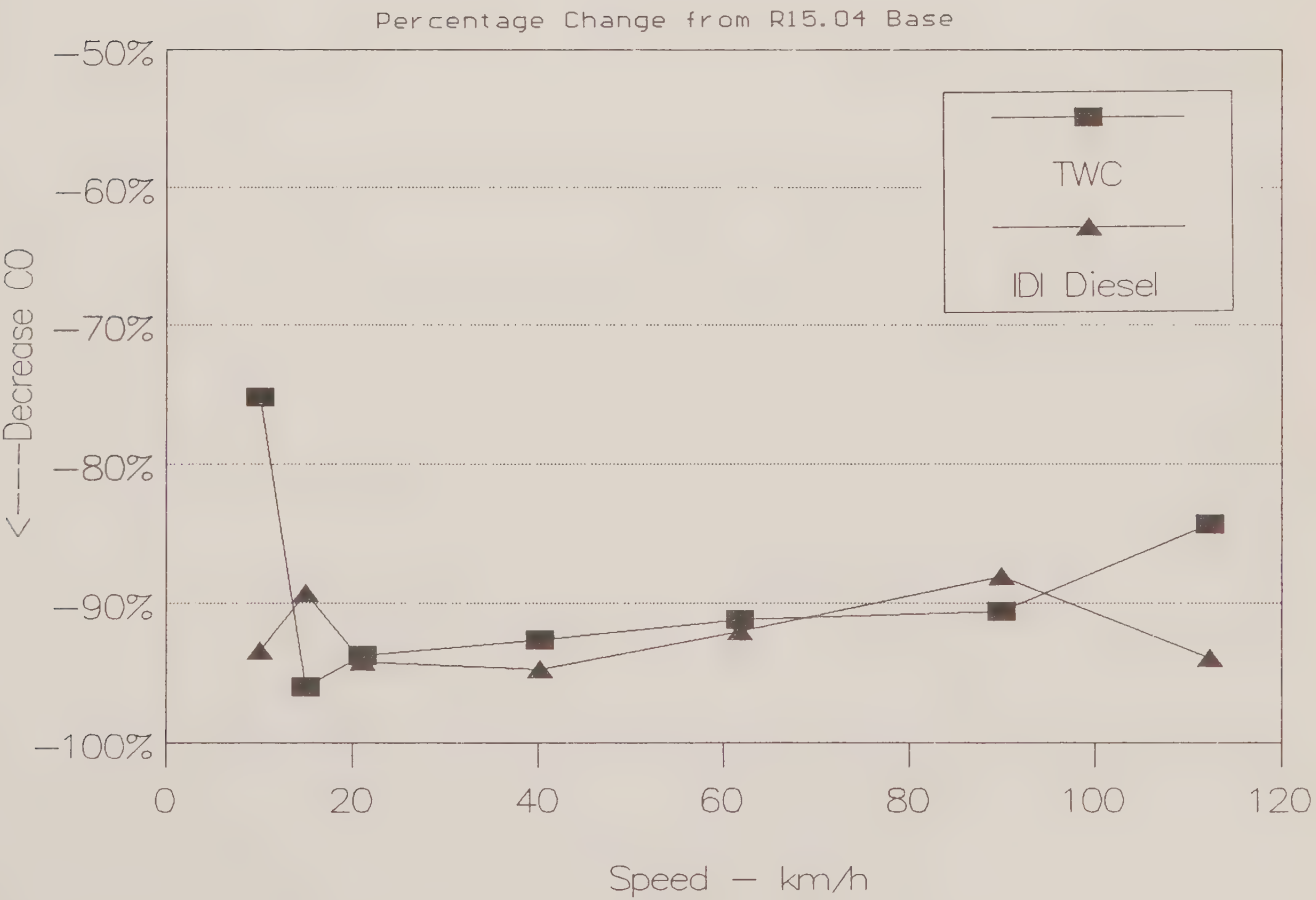
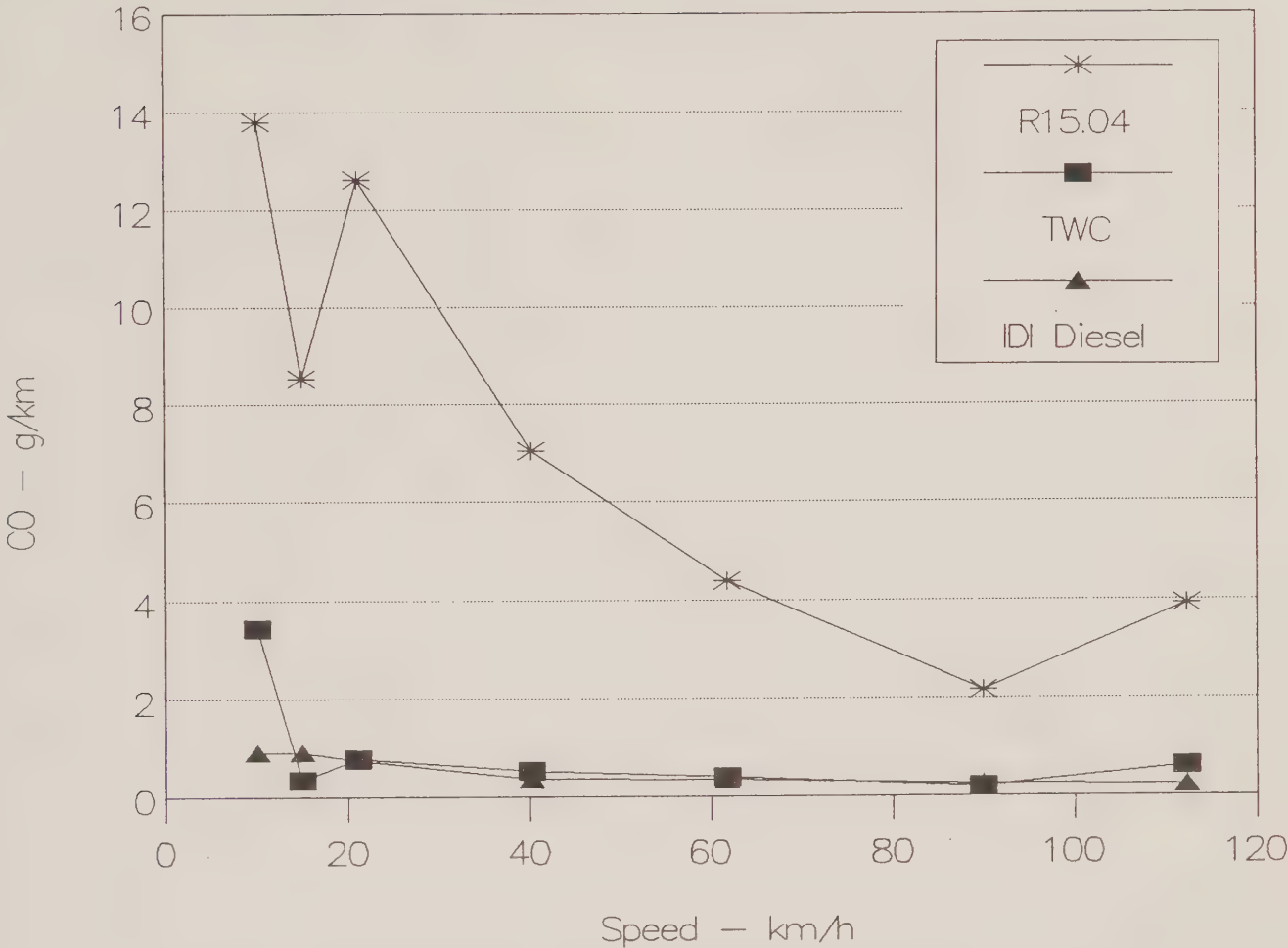


FIGURE 2. NO_x EMISSIONS

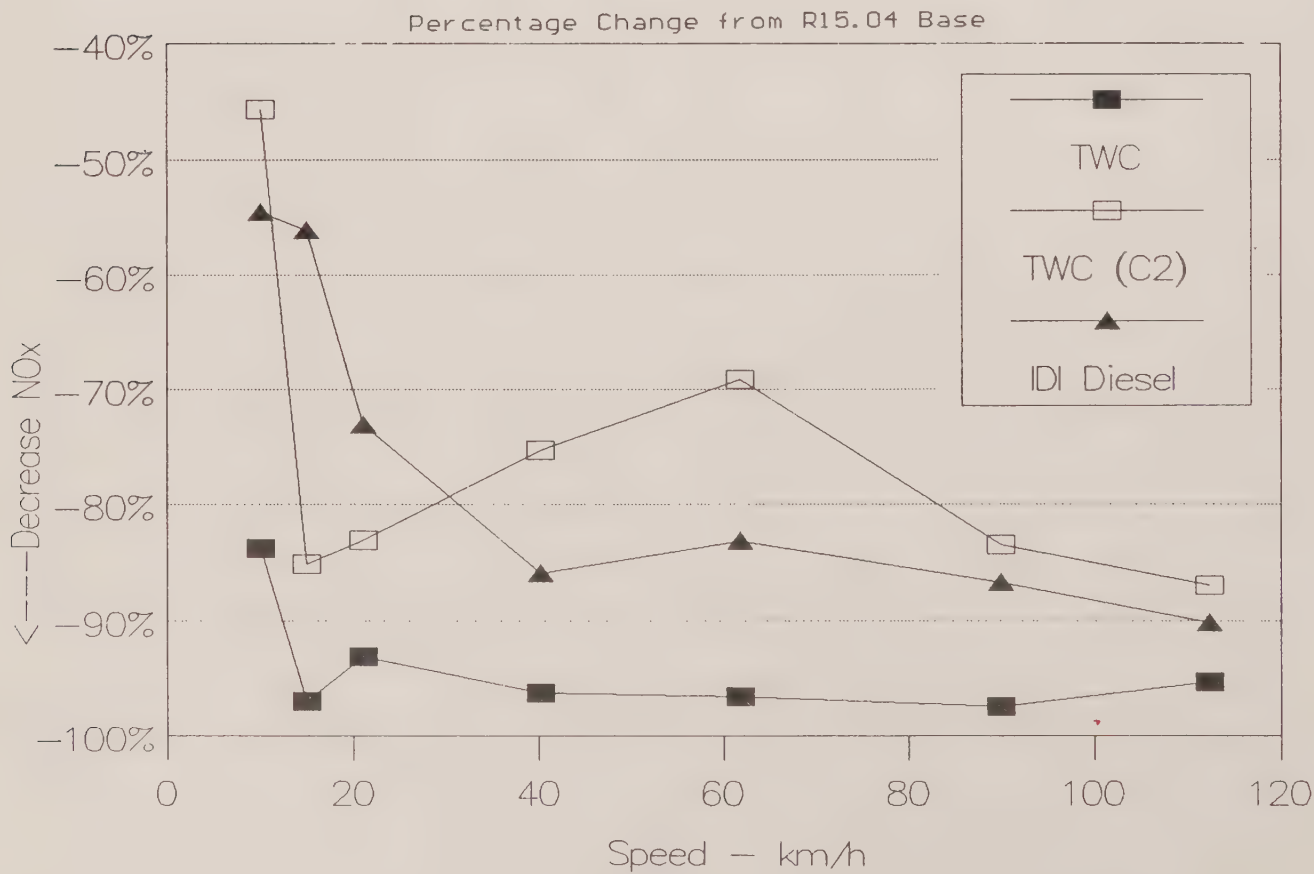
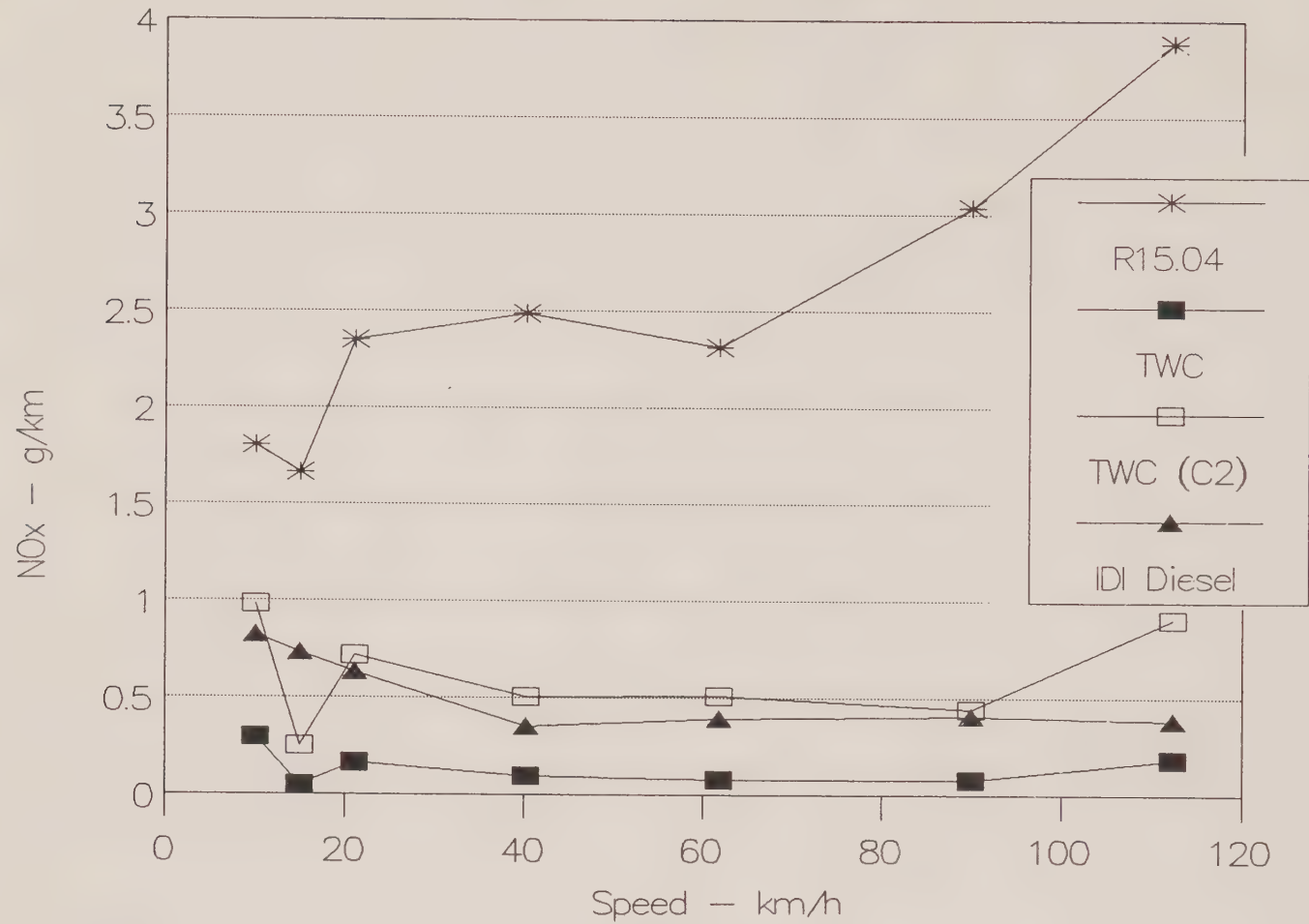


FIGURE 3. FUEL CONSUMPTION

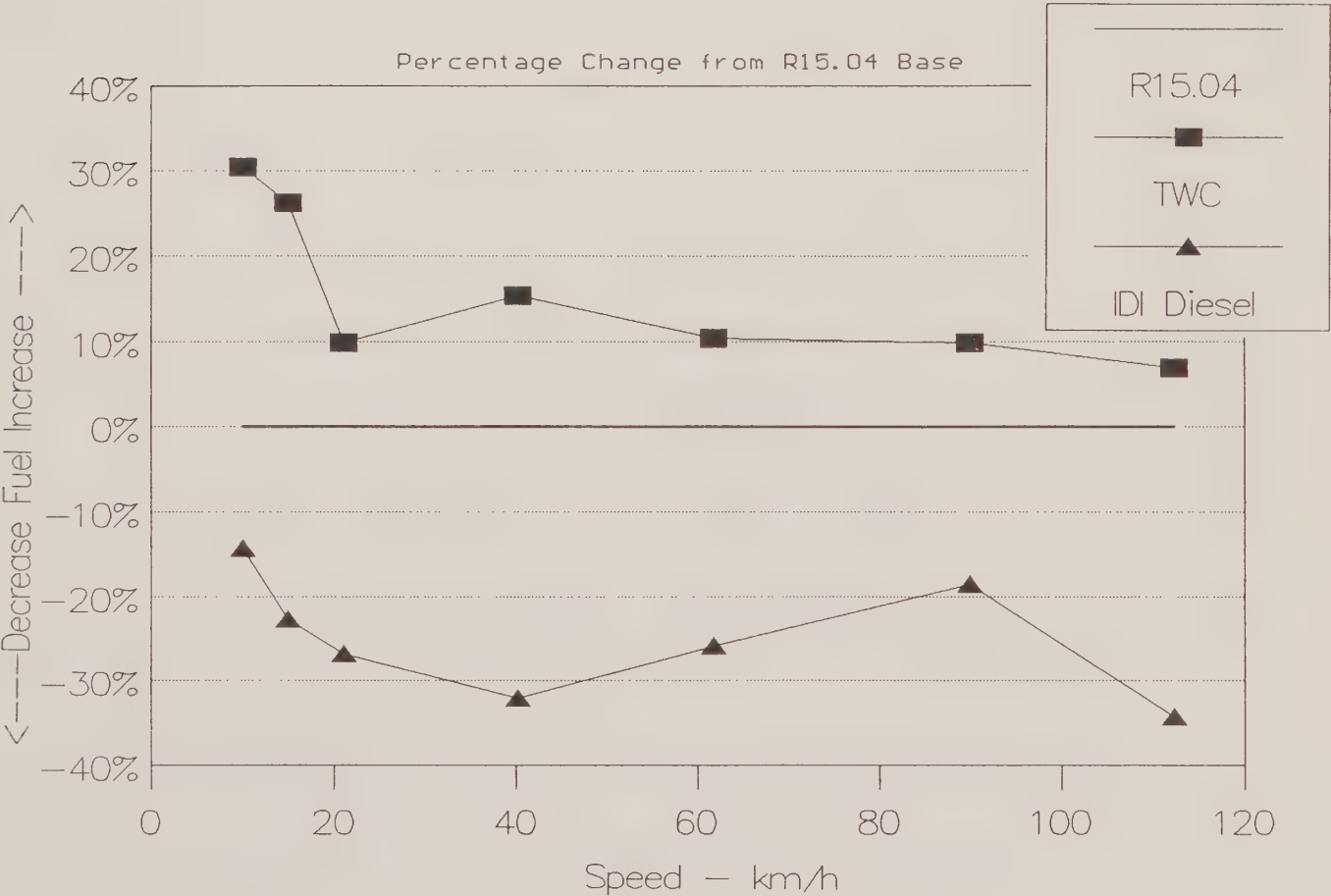
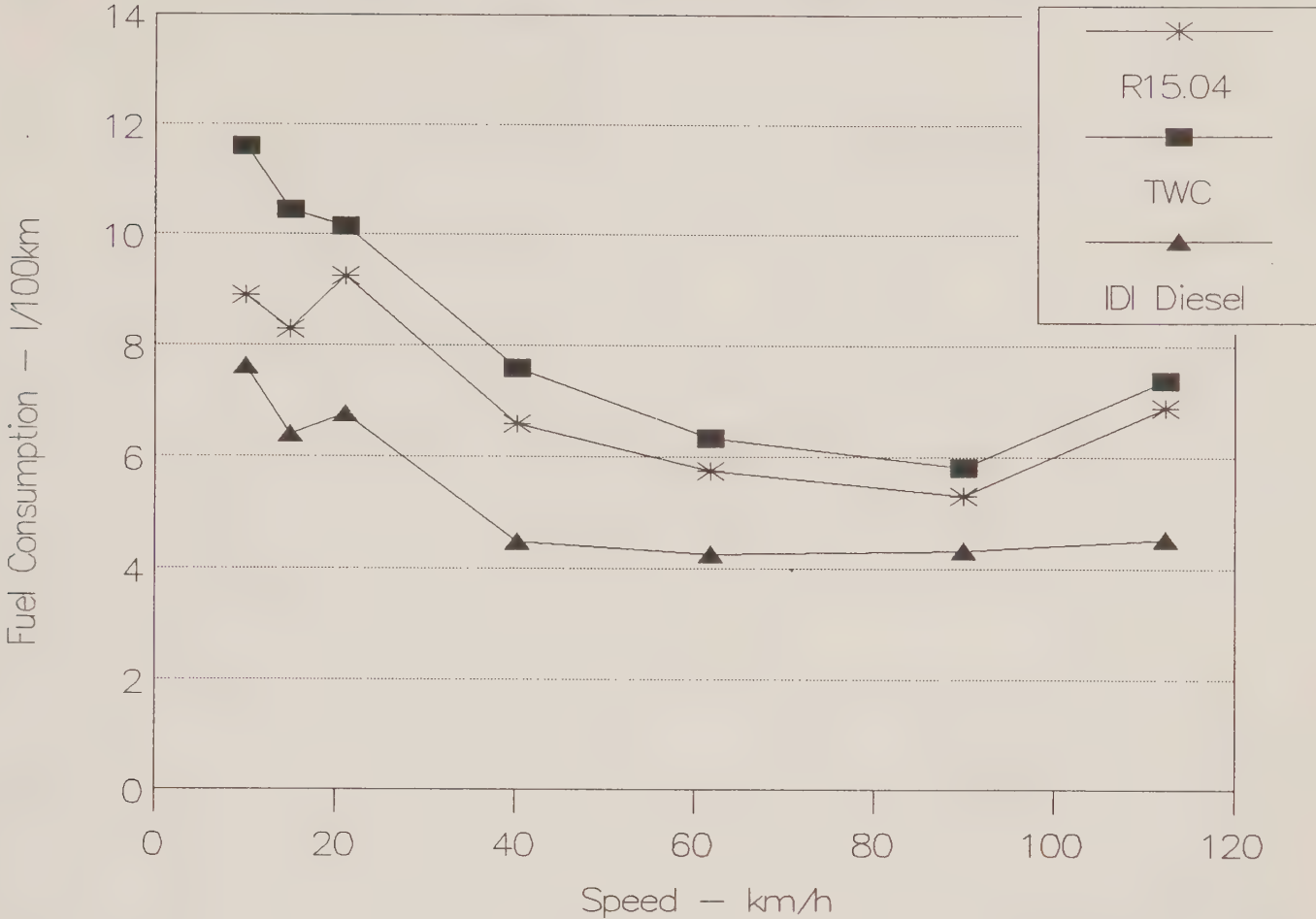


Figure 4 — Estimated UK Emissions of NO_x from Road Transport 1980-2010 (k/tonnes/yr)

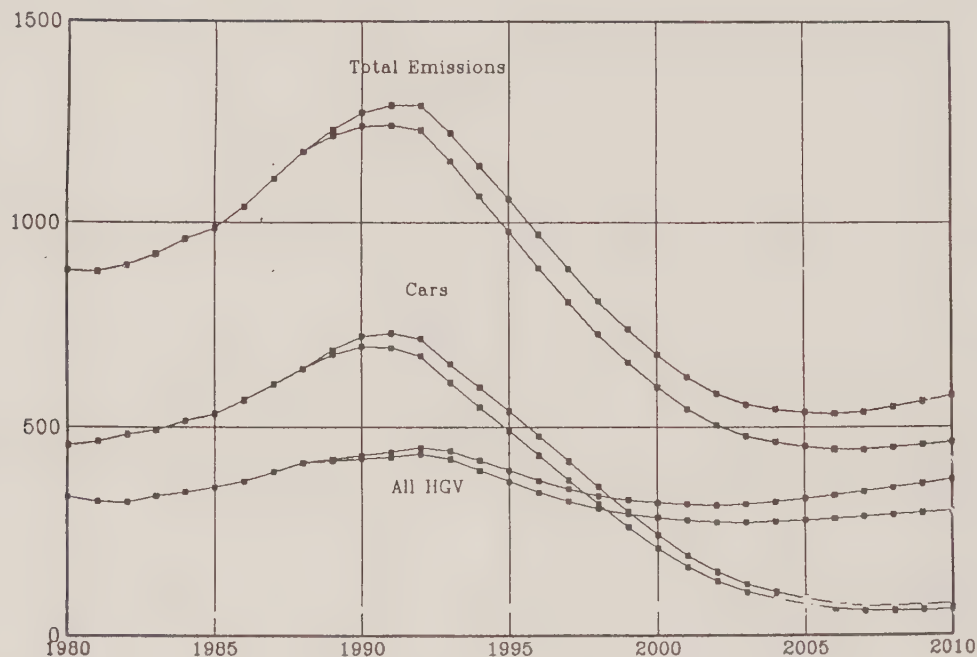
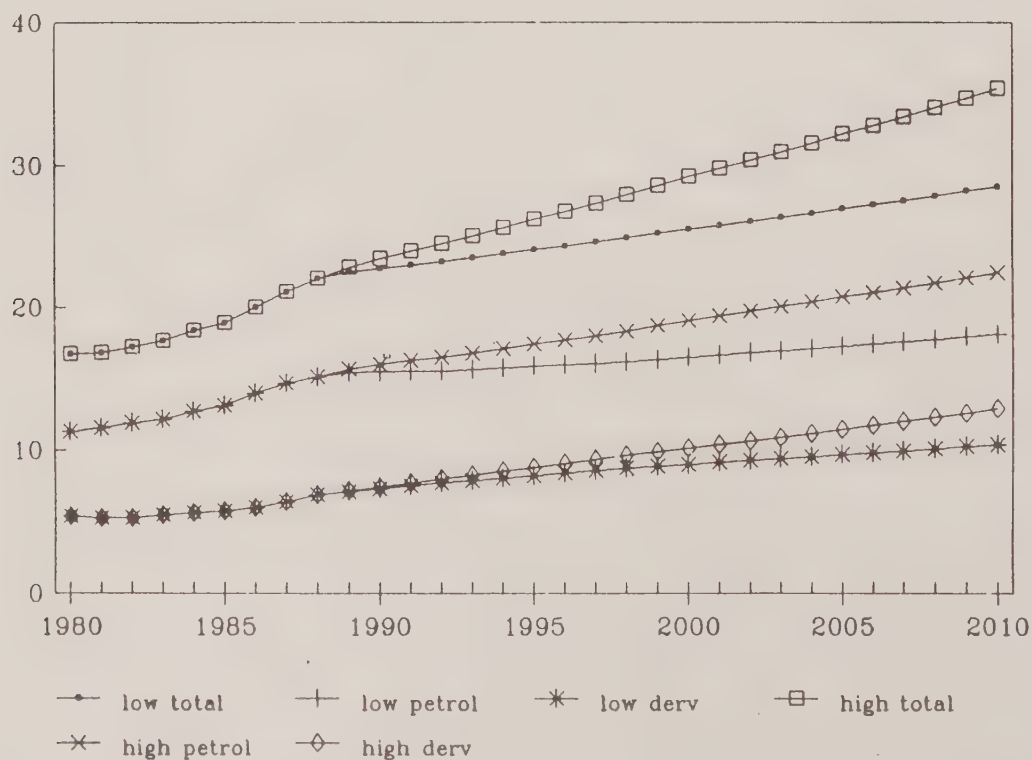


Figure 5 — Estimated UK Emissions of CO₂ from Road Transport 1980-2010 (Mt/yr)



IS ADEQUATE SOUND INSULATION BEING PROVIDED?

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1. Introduction

This paper presents the results of a systematic survey of noise insulation measures which have been used in the conversion of large older houses for multiple occupancy. With the assistance of Southwark Borough Council nearly all such conversions carried out in the borough between October 1985 and September 1988 were investigated including a substantial number of commercial and private developments. The survey included an appraisal of the effectiveness of the techniques employed based on the measurements of airborne and impact sound insulation and an analysis of the returns from a complementary social survey.

2. Site Measurements in Southwark

In all 261 floors between dwellings were tested for airborne and impact sound insulation. In all cases measurements were carried out according to BS 2750: 1980 Parts 4 and 7. The types of insulation methods installed and tested were proprietary systems, platform floors and independent ceilings, the latter included suspended floors on independent joists.

The results of the tests are presented in a way which identifies overall trends within the wide statistical variations of the measured data.

2.1 Influence of Floor Coverings

Early measurements to determine the influence of different floor coverings on impact insulation revealed the extent and significance of a problem previously encountered by the Building Research Station but rarely mentioned in the literature. The occupants of over 70 per cent of the dwellings installed some form of carpet floor covering, the presence of which drastically altered the measured impact sound insulation. A previously reported series of laboratory tests (1) has shown that improvements of over 13 dB in the impact sound insulation can be obtained with even the poorest carpeting.

The results of the present survey confirm these findings. Table 1 shows the impact noise insulation measured for eight different dwellings taken with and without carpeting which gives an average improvement as high as 24 dB.

It is clear from these results that the impact test measurements depended almost entirely on whether the floor was carpeted or not and bore little relationship to the insulating properties of the floor itself. For this reason airborne sound insulation was the main parameter used for correlating subjective and objective assessments of sound insulation performance.

Table 1: Field Measurements; Effect of Carpet on Impact Sound Insulation

Dwelling	No Carpet		Carpet with Underlay Added	
	LnT,w	AAD	LnT,w	AAD
1	64	30.1	36	29.6
2	67	28.3	41	31.1
3	59	27.3	31	31.6
4	61	28.4	35	28.5
5	57	25.7	33	28.6
6	53	28.7	36	28.3
7	61	29.9	42	31.9
8	62	27.7	40	19.4
Average	60	28.3	36	28.6

Table 2: Summary of Field Measurement of Airborne Sound Insulation

Treatment	No. in Sample	D _n T _w	
		dB	S.D.
Part treatment proprietary systems	21	45.4	2.75
Platform floors	56	49.9	4.6
Independent joist ceiling	6	50.8	0.4
Independent ceiling	164	54.0	2.7
British Gypsum M/F suspended ceiling	14	54.9	1.9

Table 3: Airborne Sound Insulation Percentile Performance

Treatment	D _n T _w 95 Percentile	per cent of floors failing to achieve D _n T _w of		
		48 dB	50 dB	52 dB
Part treatment	39	77	91	97
Platform floors	41	34	51	68
Independent joist ceiling	50	0	3	100
British Gypsum M/F suspended ceiling	52	0	1	6
Independent ceiling	49	2	7	23

2.2 Site Measurement Results

Table 2 gives a summary of the site measurements of airborne sound insulation obtained from 261 dwellings. The sample set included as “Part treatment” included all those floors with a plywood or similar material covering and some form of sound absorbing material between the joists.

Table 3 shows the percentile performance of the various floors. The 95 percentile column represents the sound insulation performance, $D_nT_{w,*}$ likely to be achieved by 95 per cent of floors installed to this design. The final column shows the percentage of floors of the given design which fail to achieve an airborne sound insulation performance $D_nT_{w,*}$ of either 48 dB or 50 dB or 52 dB respectively.

Table 4 shows the effect on airborne sound insulation performance of the separation of a new independent ceiling from the existing ceiling. The results confirm that increase in separation leads to an unambiguous improvement in performance.

3. Social Survey

The social survey was primarily concerned with the noise from neighbours transmitted through party floors in 261 converted flats for which the airborne and impact sound insulation had previously been measured. For ease of comparison and compatibility of data the questionnaire designed and used previously by the Building Research Establishment was used in this survey. We gratefully acknowledge the assistance given by the BRE in making this questionnaire available to us and providing expert canvassers to carry out the social survey.

Of the 261 premises, 42 remained unoccupied at the end of the survey period, the residents of 48 were not found at home in four visits, and the residents of 60 refused to be interviewed. The relatively small number of final interviews (111 or 41.9 per cent of the premises tested) is considered due to the flats being privately owned and the short time available for carrying out the survey. A previous survey by Langdon (2) was undertaken over a period of years and contained a considerable proportion of council properties where the residents may have felt under some obligation to co-operate with an official survey.

3.1 Survey Results

The classification of respondents is given in Table 5. Over 70 per cent of the respondents worked over 30 hours per week and left home between 07.00 and 08.30 Monday to Friday, and returned before 20.00.

It will be seen that the majority of respondents were relatively young wage earners and not retired persons as was the case in the Langdon survey (2). Some 76.5 per cent of respondents had lived in their flats for less than two years, and 90 per cent for less than three years.

Weighted standardised level difference. $D_nT_{w,}$ is a single figure rating for describing the airborne sound insulation performance of, say, a floor.

Table 4: Airborne Sound Insulation Performance vs Ceiling Separation

Separation mm	D _n T _w		No. in Sample
	dB	S.D.	
150	53.2	2.6	104
175	52.5	0.7	2
200	54.8	2.5	13
225	53.7	1.8	12
250	56.1	2.1	11
300	55.9	3.2	14
360	56.0	2.8	2
560	58.0	0	2
600	57.3	0.6	3

Table 5: Classification of respondents

Sex	Male		Female	
	58		53	
Age	18-20 years	21-30 years	31-50 years	> 50 years
	4	66	32	9

The survey showed that noise is a major disturbing factor with a higher proportion of respondents concerned with poor noise insulation than any other housing defect.

Noise from neighbours rated highly as a disturbance (15.3 per cent) but more respondents appeared disturbed by road traffic (18.9 per cent). Thus 40.5 per cent of the respondents rated noise intrusion from outside the dwellings as causing the most disturbance. Of these, 17.1 per cent rating noise from upstairs, 14.4 per cent rating noise from corridors and stairs, 7.2 per cent rating noise through walls and 6.3 per cent noise from the downstairs flat, as the most disturbing.

The noise from the flat above found to be most disturbing was footfalls (43.2 per cent) followed by TV, music and radio (39.6 per cent) and kitchen equipment such as washing machines (27.9 per cent). The noise from the flat below found to be the most disturbing was TV, radio and music (26.1 per cent), followed by banging doors (17.1 per cent) and DIY activities such as hammering or drilling (16.2 per cent).

The social activities most disturbed were watching TV or listening to the radio by making it harder to concentrate.

4. Correlation Between Subjective and Objective Surveys

The levels of significance of the correlation coefficients between objective measurement (D_nT_w) and subjective appreciation were not high. Using a two tailed test it would appear that it is the sound insulation performance of the floor/ceiling sepa-

rating living rooms that gives the best measure of the likely subjective reaction of occupants. The correlation coefficient was -0.293 with a level of significance of better than 95 per cent. The level of disturbance could not be correlated with D_nT_w to better than 85 per cent significance and it is concluded that other factors such as neighbours' behaviour patterns are more important factors than solely the acoustic performance of the party floor.

It is noted from the survey that 43.2 per cent of those troubled by noise from the flat above found footfalls most disturbing. This contrasts with the measured impact insulation rating of most dwellings being well within the recommended standard, that is with carpeting in place. This suggests that the test procedure with its emphasis on "heel tapping" may not truly represent the disturbing effect of the weight of the human body walking across a deflectable floor/ceiling. It is our view that it is the creaking of the floorboards and joists which cause most disturbance and we would recommend further work to investigate this effect with a view to changing the measurement procedures for impact sound to bring it more into line with practice.

It would appear from these results that two components are required for noise disturbance; a noisy neighbour and inadequate sound insulation. By far the more important of the two is the noisy neighbour!

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ARTICLES FOR CLEAN AIR

The Journal is always happy to receive articles and papers relating to all aspects of pollution control for possible publication in *Clean Air*. Papers should be typed, preferably double spaced; any accompanying graphs or illustrations should be of good quality and clearly labelled. Any abbreviations or acronyms should be given in full when first used. Papers will be edited to conform to the Journal's style; any other changes are of course cleared with the author. Papers for consideration should be sent to

The Editor, *Clean Air*, 136 North Street, Brighton BN1 1RG.

LEVELS OF AMPLIFIED MUSIC IN DWELLINGS

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1. Introduction

A recent survey by the Department of the Environment's Building Research Establishment (BRE)[1] found neighbourhood noise to be the most widespread source of noise disturbance after road traffic. The survey consisted of an analysis of data sheets, completed by Environmental Health Officers (EHOs), which dealt with complaints about noise sources. One-third of these sources were amplified music. The most frequent source descriptions given were: record player/Hi-fi (28 per cent), amplified music (27 per cent) and music (17 per cent). Parties formed 10 per cent of the music sub-division. Complaints to EHOs about noise from domestic premises have increased by 791 per cent between 1975 and 1985. During this period, record and tape playing equipment has increased considerably in its power output and frequency range reproduction. Furthermore compact disc players, with their wide dynamic range capability, are becoming more readily available. Also, the results of a survey of Open University students suggests that it is not uncommon to find more than one set of hi-fi equipment per household. Thus, one might expect an increase in amplified music disturbances. The research reported in this paper has been concerned with potential noise nuisance caused by amplified music in dwellings. Investigations have included: (i) amplified music listening levels; (ii) analysis of reported amplified music disturbances through calibrated recordings; and (iii) the implications for party wall insulation standards.

2. Amplified Music Listening Levels

Data supplied by Open University students as part of their studies of a second level undergraduate course (T234 Environmental Control and Public Health) have been used to indicate amplified music listening levels. The students, supplied with integrating sound level meters, are asked to measure three amplified music listening levels ($L_{Aeq,2min}$), representing the loudest, the quietest and a typical level at which they normally listen to amplified music. They are instructed that the measurement period should not contain appreciable periods of silence and that they should measure levels corresponding to their judgement of loud, quiet and typical levels. Table 1 and Figure 1 present the resulting data on measured listening levels. Further information about student meters and measurements may be found elsewhere [2].

It can be seen from Figure 1 that although there is overlap between them there is approximately 10 dBA difference between the mean value for each listening level category. Subjectively a 10 dBA increase represents a doubling of the loudness. [3].

Other factors that might influence listening levels have been investigated. These include:

a) the type of hi-fi equipment used, since the comparative lack of distortion may

persuade students using compact disc players as a source to listen at higher levels;

- b) type of dwelling, since concern for disturbing their neighbours may persuade students living in flats to listen at lower levels than those living in detached dwellings;
- c) attendance at a discotheque or use of personal cassette players (PCPs) since regular attendees or users may prefer higher listening levels in an attempt to emulate the levels heard in the discotheque or while using PCPs, and
- d) the type of music listened to since students may listen to pop music at louder levels than are preferred for classical music.

Table 1: Statistical Summary of Listening Levels

Statistics	Typical dBA	Quiet dBA	Loud dBA
Mean	63.5	53.5	74.4
Standard deviation	6.34	7.11	7.85
Minimum	48.0	35.0	55.0
Maximum	82.0	70.0	98.0
Range	34.0	35.0	43.0
Lower quartile	59.0	48.0	69.0
Upper quartile	67.0	58.0	79.0
n	83	83	84

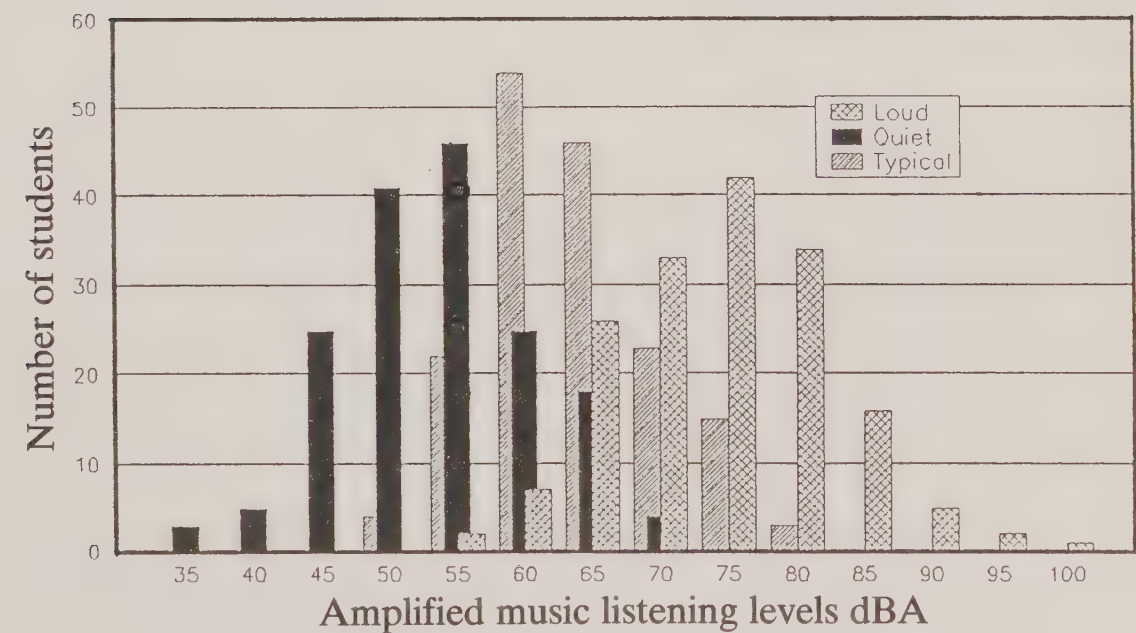


Figure 1: Range of Amplified Music Listening Levels

The student's *t*-test enables identification of cases where the mean listening level for a particular factor under investigation differs significantly from the overall mean listening level, e.g one might expect the mean *quiet* listening level for students living in flats to be lower than the mean *quiet* listening level for all students. The results of application of this test for 22 students who regularly use PCPs are shown in Table 2. An * indicates a significant result. In general a result is considered to be significant when a statistical test yields a value whose associated probability of occurrence is equal to or less than the significance level of $p = 1.05$ or $p = 0.01$. On this basis, the following conclusions have been drawn from all the data:

- a) the type of equipment did not significantly influence listening levels;
- b) dwelling type did not significantly influence listening levels;
- c) regular use of PCPs may be influencing listening levels for amplified music in the home;
- d) the type of music listened to did not generally affect listening levels.

Table 2: Mean Listening Levels for Regular Users of PCPs (n = 22)

Listening Level	Mean $L_{Aeq,2min}$	Standard Deviation	S.E. of mean	t	p value
Quiet	53.9	10.39	2.22	0.18	0.86
Typical	66.1	6.51	1.39	1.90	0.07
Loud	78.1	7.21	1.54	2.40	0.03*

From Table 2 it can be observed that the mean *loud* listening level for regular users of PCPs was significantly higher than the overall mean *loud* listening level, thus suggesting that PCP users may be emulating the level they experience while using the PCP. Only two students regularly attended the discotheques. Therefore statistical analysis of their data is not valid.

The main sub-divisions of type of music were classical, pop and rock music. The mean listening levels for each type of music were compared with overall mean listening levels. The *t*-test analysis is presented in Table 3. The exception to the general conclusion above concerning type of music is that the mean *quiet* listening level for those listening to rock music was significantly higher than the mean *quiet* listening level overall.

Incidentally, student's perception of their own listening levels were investigated. Students were asked to rate their own listening level according to a four category scale — Very loud, Loud, Quiet, Very quiet. The results of the *t*-test on subjective ratings can be seen in Table 4.

Although the mean listening levels recorded for students with **Very loud** subjective rating were higher than the means overall, there were only two students in this rating category. Therefore the results are not statistically valid and are not included in Table 4. *Quiet* and *typical* listening levels for students who rated their listening level as **Loud** were significantly higher than overall *quiet* and *typical* levels. Moreover, *quiet* and *typi-*

Table 3: Mean Listening Levels for a Variety of Music Types

Type of Music	Listening Level	Mean L _{Aeq,2min}	Standard Deviation	S.E. of mean	t	p value
Classical n=40	Quiet	52.1	6.68	1.06	−1.35	0.19
	Typical	62.7	5.67	0.90	−0.95	0.35
	Loud	73.2	7.55	1.19	−0.98	0.33
Pop n=57	Quiet	53.2	7.36	0.98	−0.30	0.77
	Typical	63.5	6.32	0.84	0.05	0.96
	Loud	74.8	7.57	1.00	0.42	0.67
Rock n=50	Quiet	55.6	7.46	1.05	1.97	0.05*
	Typical	65.1	6.66	0.94	1.65	0.10
	Loud	75.6	8.15	1.15	1.02	0.31

Table 4: Mean Listening Levels for a Variety of Subjective Ratings

Subjective Rating	Listening Level	Mean L _{Aeq,2min}	Standard Deviation	S.E. of mean	t	p value
Loud n=61	Quiet	56.5	7.03	0.90	3.36	0.001*
	Typical	65.8	5.87	0.75	3.11	0.002*
	Loud	75.2	7.16	0.92	0.87	0.39
Quiet n=98	Quiet	51.8	6.57	0.66	−2.51	0.014*
	Typical	62.1	6.33	0.64	−2.20	0.03*
	Loud	73.5	7.99	0.80	−1.06	0.29

cal listening levels for students who rated their own listening level as **Quiet** were significantly lower than overall *quiet* and *typical* levels. Mean *loud* listening levels for subjects who rated their listening level as **Loud** or **Quiet** were not significantly different from overall *loud* listening levels.

3. Analysis of Complaint Data

Amplified music disturbances constituted 34 per cent of all noise sources reported to EHOs. The City of Birmingham Environmental Services Department has established an Environmental Protection Unit to facilitate detailed monitoring of noise complaints on request. The monitoring equipment (a Nagra IV SJ tape recorder and one-inch microphone (Bruel and Kjaer Type 4145)) is installed in the complainant’s home and recordings are made during any disturbances. These calibrated tape recordings have been made available for analysis.

The first author carried out similar monitoring in Milton Keynes with the co-operation of the Environmental Health Department of the Borough of Milton Keynes. Domestic amplified music disturbances have been monitored using the equipment listed above. The calibrated (unweighted) recordings are replayed into an Ono Sokki FFT 910 analyser, to obtain: overall dBA levels and one-third octave band information.

Received noise levels (i.e. the levels transmitted from the source in the adjacent dwelling to the complainant's dwelling) range from 28 to 50 dBA, with a mean level of 41.3 dBA (standard deviation of 6.0 dBA). Seventeen of the 18 cases studied had received noise levels in excess of 30 dBA. Eleven cases examined had received levels in excess of 40 dBA, and five had received levels in excess of 45 dBA. Typically the music causing a disturbance is pop music (including *soul* and *reggae*).

Analysis of received one-third octave band spectra (dB) reveals that there are significant amounts of energy in the frequency range from 50 Hz to 3.15 kHz. Much of the acoustic energy lies within the one-third octave bands between centre frequencies at 80 and 200 Hz bands, with significant amounts up to 3.15 kHz. However, highest dB levels occur most often in the one-third octave bands with centre frequencies 50 to 100 Hz. This accounts for the low frequency bass noise, which is characteristic on all recordings. This low frequency content has important implications for party wall insulation standards and this is discussed in the next sections.

4. Implications for Party Wall Insulation Standards

With the increasing incidence of complaint about amplified music disturbances, the adequacy of sound insulation for party walls and floors is called into question. By calculating and estimating levels of noise received in an adjoining dwelling through various models of wall insulation and by suggesting possible annoyance criteria, it is possible to assess the likelihood of nuisance from amplified music received through each of these insulations.

4.1 Model Insulation

Three sound insulation models have been chosen: *good insulation* — based on the BS5821 reference values for airborne sound [4] (henceforth referred to as model 1); *poor insulation* — derived from the curve for a cavity masonry wall with poor performance, extracted from the measurements of the performance of plastered walls of light-weight aggregate blockwork [5] — the one-third octave band levels chosen correspond to the mean minus 1.64 standard deviations at each frequency, (henceforth known as model 2); and *partition wall insulation* — based on one-third octave values of airborne sound reduction for 75 mm aerated concrete, plastered on both sides [6] (to be referred to as model 3). This partition insulation is intended to represent typical ground floor room to room insulation since this will help assess the likelihood of disturbance within a dwelling. Table 5 presents the values used for each insulation model.

These curves will be used to calculate the received noise levels for a typical amplified music listening level and to determine a hypothetical source level from a recorded extreme case of amplified music disturbance.

4.2 Source Levels and Spectra

One-third octave band data relating to a typical listening level has been abstracted from recordings of different types of amplified music made in the living room of a semi-detached dwelling (using the equipment detailed earlier), at normal listening levels. The microphone was positioned at the ear level of a listener, seated in a chair. One-third

Table 5: Reference Values for the Insulation Curves

Frequency Hz	Good Insulation dB (Model 1)	Poor Insulation dB (Model 2)	Partition Insulation dB (Model 3)
100	33	25	24
125	36	28	25
160	39	30	27
200	42	32	24
250	45	35	27
315	48	38	32
400	51	40	33
500	52	43	28
630	53	47	37
800	54	49	41
1000	55	51	43
1250	56	53	44
1600	56	53	46
2000	56	54	48
2500	56	56	49
3150	56	58	49

octave band spectra were obtained by replaying the calibrated recordings into an FFT analyser (Ono Sokki 910). Measurements of L_{Aeq} were made for each track of music using a CEL 393 precision computing sound level meter. Most of the acoustic energy lies between 315 Hz and 1.25 kHz for a selected piece of classical music. However, selected tracks of popular music had a good deal of acoustic energy between 80 and 250 Hz.

Two listening levels and representative spectra have been obtained from the data described above and in section 3: a typical spectrum corresponding to an overall level of 67 dBA, based on a recording of popular music; and a loud spectrum with an overall level of 92 dBA, corresponding to a recorded received level of 49 dBA and an assumed insulation model 2. The assumption has been made that amplified music disturbances are reported to EHOs when music is being played loudly, through a party wall offering poor insulation, and that the music played has the same frequency characteristics as the music used to represent a typical level. It should be noted that overall values of two levels chosen for this analysis are representative of *typical* and *loud* levels recorded by Open University students. (See Figure 1).

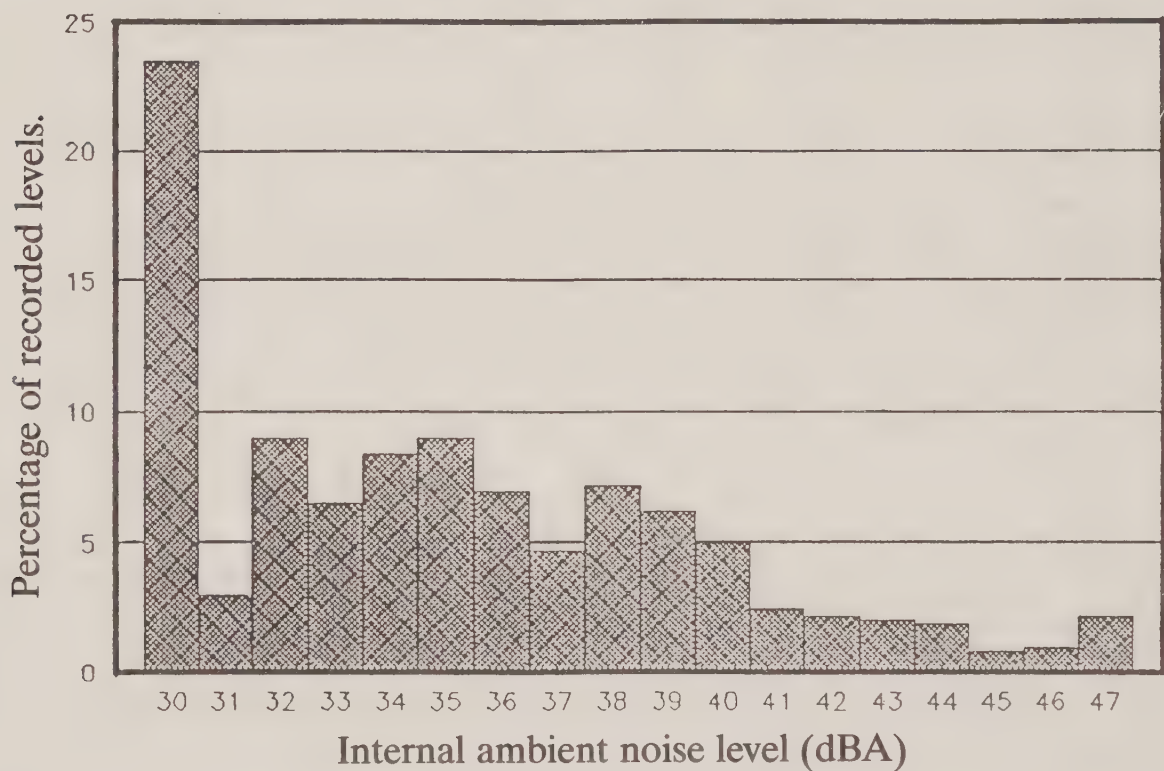
4.3 Internal Ambient Noise Levels and Spectra

To assess whether the received noise resulting from the two amplified music listening levels will be audible in an adjoining dwelling, a comparison has to be made with the internal ambient noise level.

4.3.1 Measured Levels and Spectra

Open University students of T234 (Environmental Control and Public Health) have also measured levels of ambient noise inside their homes. These measurements were made when the room was free from any sound sources. One limitation of the data is that the sound level meters used by students could only measure noise levels down to 30 dBA. Twenty-four per cent of students had ambient noise at or below this level. The range of internal ambient noise levels can be seen in Figure 2. Fifty per cent of students recorded a level of 34 dBA or less.

Figure 2: Range of Internal Ambient Noise Levels Recorded by Students (n=238)



The threshold at which sound becomes audible will vary from individual to individual. According to Utley et al [7] when the spectrum of the received sound is similar to that of the ambient noise, the sound will probably be inaudible if its overall level is similar to or below the ambient level. However, if the received sound spectrum is markedly different from that of the ambient noise, the sound may be audible even when the overall level is as much as 10 dBA below ambient.

Measurements of the internal ambient noise levels have been made in the living room of two dwellings: a timber-framed, semi-detached dwelling; and a breeze-block detached dwelling, in the absence of any sound source, using a CEL 393 precision computing sound level meter. $L_{Aeq,5minutes}$ was found to be 27.4 dBA in the semi-detached dwelling and 25.7 dBA in the detached dwelling. These values are consistent with 24 per cent of the values presented in Figure 2. Calibrated tape recordings of the ambient noise were also made, using the equipment previously detailed. The microphone was positioned on a tripod, 1.2m high and at least 1m away from the nearest reflecting sur-

face. One-third octave band spectra were obtained by replaying the recordings through an Ono Sokki 910 FFT analyser. Since the resulting spectra had similar shapes, that corresponding to the higher overall level has been used in the rest of this paper. By superimposing the calculated received noise spectra of amplified music onto the ambient noise spectra, one can identify whether the ambient noise is exceeded.

4.3.2 Internal Ambient Noise Spectra Deduced From Noise Rating Curves

It has been recommended that the noise levels inside bedrooms and living rooms should not exceed the NR 25 and 30 curves respectively. It is possible to compare the octave band received spectra of the amplified music assuming the three model insulations with these curves to identify when NR values are exceeded.

4.4 Received Noise Assessment

Overall received levels for *typical* and *loud* amplified music listening levels were calculated to be 16 and 42 dBA respectively with insulation model 1, 26 and 49 dBA respectively with model 2 and 25 and 55 dBA with model 3.

4.4.1 Comparison with Measured Background Spectra

Table 6 presents the one-third octave band frequencies for which the received noise levels exceed the internal ambient noise level by at least 3 dB.

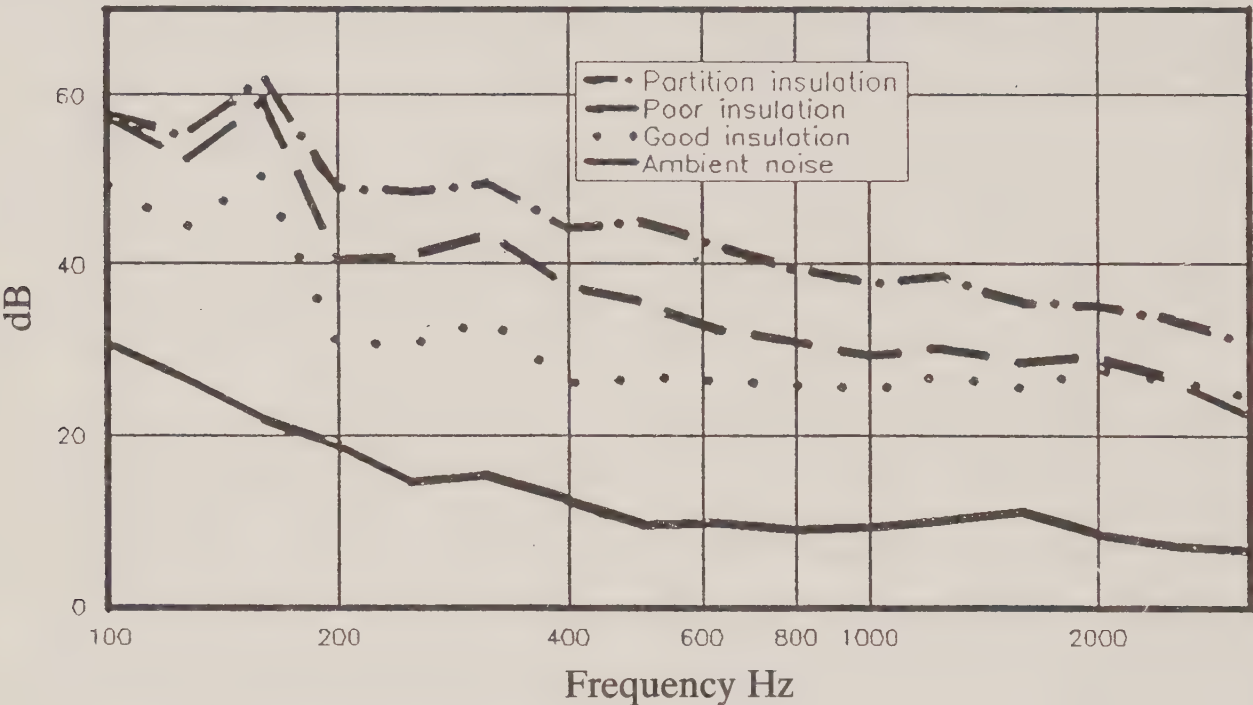
Table 6: One-third Octave Band Frequencies for which Received Noise Exceeded Internal Ambient Noise

Listening Level	Good Insulation One-third octave frequency band - Hz	Poor Insulation One-third octave frequency band — Hz	Partition insulation octave frequency band — Hz
Typical level	—	100-200	100-200, 400
Estimated loud level	100-3150	100-3150	100-3150

Figure 3 presents one-third octave band spectra of the internal ambient noise and received noise of the estimated loud amplified music, assuming the three insulation models. The received noise levels of amplified music exceeded internal ambient noise across the frequency range, the extent of which depends on the insulation model.

In the absence of other noise in the receiver dwelling, both the typical and loud received noise spectra, assuming insulation models 2 or 3, would exceed a typical ambient spectrum, particularly in the low frequency bands. Moreover, it should be noted that the one-third octave band spectra are rather different from the internal ambient spectra. Consideration should also be given to a higher overall ambient level. Ninety-five per cent of Open University student data fell below 42 dBA. Assuming the same spectrum shape as in Figure 3, loud amplified music will still give rise to received levels that significantly exceed the ambient spectrum across the frequency range, through all models of insulation.

Figure 3: One-third Octave Band Spectra of Received Loud Amplified Music Compared with a Typical Internal Ambient Noise



4.4.2 Comparison with Noise Rating Curves

Octave band spectra of the calculated received noises were compared with NR curves. Table 7 presents the resulting NR values.

Table 7: Noise Rating Values for Amplified Music in an Adjoining Dwelling

Listening Level	Good Insulation (Model 1)	Poor Insulation (Model 2)	Partition insulation (Model 3)
Typical level	7	16	16
Estimated loud level	31*	39*	45*

The NR values for the received noise associated with the loud listening level exceed the recommended NR values for living rooms and bedrooms, for all insulation models.

5. Discussion of Results and Conclusions

- Amplified music listening levels ranged from 35 to 98 dBA depending on the mode of listening — *quiet, typical* or *loud*. Mean listening levels were 53.5, 63.5 and 74.4 dBA respectively.
- Neither type of hi-fi equipment or type of dwelling affected the listening levels significantly. However, the use of personal cassette players resulted in significantly higher *loud* listening levels. Furthermore the levels rated as *quiet* by students who listened to rock music were significantly higher than those rated as quiet by students listening to other types of music.

- Received levels of amplified music which resulted in a complaint to EHOs ranged from 28 to 50 dBA, with a mean level of 41.3 dBA. Received levels were in excess of 45 dBA for five of the cases investigated.
- Amplified music has been demonstrated as constituting a noise problem. Received noise levels for both the *typical* and *loud* listening levels were sufficiently great for them to be audible above the internal ambient noise level with insulation models 2 and 3. Moreover, their frequency spectra are markedly different from those of internal ambient noises, especially at low frequencies. This low frequency effect is noticeable on all recordings.
- Use of NR values for the received noise would suggest that amplified music is only a source of disturbance when the listening level is high. However, this conclusion is not consistent with Table 6. NR curves discriminate against low frequencies (as does A-weighting), and this discrimination may be inappropriate for the assessment of disturbance by amplified music.

The spectral analyses and calculations presented in this paper suggest the need for good sound insulation in dwellings at low frequencies, to reduce amplified music disturbances in the future.

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UPDATE

ENVIRONMENTAL PROTECTION BILL

The Bill is now in the Lords, with completion of the Committee Stage expected during July. However, due to the heavy workload of the Lords, report stage is not now expected to take place until the Autumn, which in turn means that the Bill is unlikely to receive Royal Assent until late 1990.

The White Paper setting out the Government's further thinking on environmental policy is, however, expected to be published in September, in time for the Party Political Conferences.

IMPLEMENTATION OF IPC

The Government has published detailed plans for introducing integrated pollution control under Part I of the *Environmental Protection Bill*.

On the assumption that the Bill receives Royal Assent later in 1990 it is intended to introduce the new system of IPC in England and Wales on 2 January 1991. All new processes prescribed for IPC, and all existing processes which are to be substantially altered, will be required to apply for an authorisation under Part I of the Bill from that date. Existing processes other than those which are substantially altered will be brought sector by sector into the IPC system by means of a phased programme. The first sector, combustion processes (which will

include the most significant plant covered by the Large Combustion Plants Directive) will be required to seek an authorisation from 2 January 1991. Preparation of IPR (Integrated Pollution *Regulation* Notes for all Part A Prescribed Processes is expected to be completed by April 1995.

BATNEEC

A draft guidance note has been published setting out the Government's general interpretation of the concept of "Best Available Techniques Not Entailing Excessive Cost" (BATNEEC) that is applied under Part I of the Bill so that the release of certain substances into the environment is prevented or minimised and that substances released from prescribed processes are rendered harmless. The Guidance Note says that in reducing the emissions to the lowest practicable amount, account needs to be taken of local conditions and circumstances, both of the process and the environment, the current state of knowledge, and the financial implications in relation to capital expenditure and revenue cost.

So far as "BAT" is concerned the Note says "It is necessary to construe the words Best Available Techniques separately and together.

"Techniques" embrace both the process used and how that process is operated. The word should be taken to

mean the concept and design of the process, the components of which it is made up and the manner in which they are connected together to make the whole. It should also be taken to include matters such as staff numbers, working methods, training, supervision and manner of operating the process.

“Available” should be taken to mean procurable by any operator of the class of process in question. It does not imply that the technology is in general use, but it does require general accessibility. It does not imply that sources outside the UK are “unavailable”. Nor does it imply a multiplicity of sources. If there is a monopoly supplier the technique counts as being available provided that any and all operators can procure it.

“Best” must be taken to mean most effective in preventing, minimising or rendering harmless polluting emissions. On this definition, there may be more than one set of techniques that achieves the same degree of effectiveness — i.e. there may be more than one “best” techniques. It implies that the technology’s effectiveness has been demonstrated.”

The Guidance Note says that “NEEC” — Not entailing excessive cost — needs to be taken in two contexts, depending on whether it is applied to new processes or to existing processes. “The presumption will be that best available techniques will be used, but that presumption can be modified by economic considerations where it can be shown that the costs of applying best available techniques would be excessive in relation to the environmental protection to be achieved. If, for instance, there is one

technology which reduces the emission of a polluting substance by 90 per cent and another which reduces the emissions by 95 per cent but at four times the cost, it may be a proper judgement to hold that because of the small benefit and the great cost, the second technology would entail excessive cost. If the emissions were particularly dangerous, on the other hand, it may be proper to judge that the additional cost was not excessive.”

AMENDED FUEL REGULATIONS

The *Oil Fuel (Sulphur Content of Gas Oil) Regulations 1990* which came into effect on 14 June revoke the 1976 Regulations of the same name. They apply to England, Wales and Scotland, and provide that, subject to certain specified exemptions, no person shall use, or cause or permit to be used, in any furnace or engine (other than one in a ship or diesel engined motor vehicle) gas oil with a sulphur content greater than 0.3 per cent by weight. Furnaces or engines used in power stations are no longer exempt from the Regulations.

The *Motor Fuel (Sulphur Content) of Gas Oil (Amendment) Regulations 1990* also came into effect on 14 June and apply throughout the United Kingdom. They amend 1976 Regulations of the same name as follows:

1. The prescribed maximum amount of 0.3 grammes of sulphur in 100 grammes of gas oil now applies to fuel for all diesel engines used to propel any mechanically propelled vehicle including agricultural vehicles and engineering plant, intended or adapted for use on roads.
2. The prescribed maximum amount

of 0.3 grammes now applies to the production etc. or use of gas oil for, or in, diesel engines which propel motor vehicles in the island areas of Orkney and Shetland. The previous maximum amount in those areas was 0.5 grammes.

3. The exemption for the importation and use of gas oil in the tank of a motor vehicle entering the United Kingdom is restricted to vehicles entering from States which are not Member States of the European Community.

4. The use of gas oil with a sulphur content not exceeding 0.5 per cent in the user's possession on 31 December 1988 is exempted from the Regulations in specified cases.

5. The definitions of "gas oil" and the "appropriate method" for testing "gas oil" are brought up to date.

AIR QUALITY STANDARDS, N. IRELAND

Regulations implementing EEC Council Directives on air quality limit values and guide values for sulphur dioxide and suspended particulates, a limit value for lead in the air, and the Directive on air quality standards for nitrogen dioxide, came into operation on 31 May 1990.

The Regulations require the amounts in the air of suspended particulates and sulphur dioxide (considered both separately and in association), lead, and nitrogen dioxide to be measured as necessary to comply with the Directives, and where applicable reduced below specified limit values. They do not apply to exposure to lead in the air as a result of a person's occupation, nor to nitrogen dioxide in the atmosphere at work or within build-

ings. The Regulations enable the Department of the Environment to direct district councils to create smoke control areas under Article 17 of the Clean Air (Northern Ireland) Order 1981, in order to comply with the requirements of the Directive on air quality limit values and guide values for sulphur dioxide and suspended particulates.

Similar Regulations came into operation in the rest of the United Kingdom on 31 March 1989.

SMOKE CONTROL AREAS

Smoke Control Zones covering a further 150,000 homes are planned for 1990/1991, according to the Solid Smokeless Fuels Federation. So far 19 zones have already been declared this year, with a further 50 planned for 1991. Most of the new zones are in the mining regions of the North East, Yorkshire and the Midlands.

TYRE BURNING

Langbaurgh BC have successfully prosecuted a farmer under s.1 of the *Clean Air Act 1968* for causing dark smoke by burning tyres on his land. A total of £200 fine plus £40 costs were awarded. The defence that the land was not "trade premises" as defined by the Act was not accepted following the production in Court of a letter from Environment Minister David Heathcoat-Amory to the National Society for Clean Air (*Clean Air*, Spring 1990, p.8). This stated the DOE view that agricultural land should be covered by the 1968 Act.

One area of uncertainty remains. Agricultural training manuals advise that plastic pesticide containers should

be disposed of by controlled burning. Burning might be preferred to dumping, but could be used as an excuse for burning larger quantities of waste.

DTI ENVIRONMENT PROGRAMME

The enquiry point set up under the DTI's Environmental Programme launched in May 1989 (see *Clean Air*, Summer 1989) has already dealt with more than 4,000 enquiries. The Enquiry Point was set up to provide business and local authorities with comprehensive advice and information on a wide range of environmental issues. During the last year enquiries have covered areas such as monitoring of emissions, waste disposal, recycling and legislation. The service is provided through Warren Spring Laboratory and other specialised sources and enquirers may have up to four hours free advice or consultation.

The Environmental Enquiry Point can be contacted on Freephone 0800 585 794.

GREEN ADVERTISING

The Independent Television Association has published guidelines for advertisers on making claims as to the environmental worthiness of products in TV and radio advertisements. The guidelines drawn up in consultation with environmental groups say that all claims "must be supported by sound factual evidence acceptable to the ITV association and its technical advisers". Claims such as "environment friendly" or "green" are unlikely to be approved, although saying an item is "friendlier" than another to the environment (e.g. unbleached nappies versus bleached ones) may be acceptable. Advertisers

may not claim that a particular product is "free from" a certain ingredient, particularly if it never contained it in the first place, or has been replaced by another ingredient just as damaging to the environment.

OZONE AGREEMENT

More than 100 countries were represented at the meeting held in London at the end of June to review and strengthen the 1987 Montreal Protocol to protect the stratospheric ozone layer.

Detailed negotiations and bargaining over ten days resulted in agreement to completely phase-out CFCs and halons (except for essential safety uses) by the year 2000. Controls were also agreed on three further chemicals not covered by the Montreal Agreement. An 85 per cent cut by 1995 and phase out by 2000 in carbon tetrachloride and a 70 per cent cut by 2000 for methyl chloroform and its phase out by 2005; no specific controls were placed on HCFCs but the final declaration notes that they should be used carefully, and phased out by 2020-2040.

A major step forward is the declared intention of both China and India to sign and ratify the Protocol. They and other developing countries will be given an additional ten years to implement the Agreement. In addition a special fund to be operated by the World Bank, the UN Environment Programme and the UN Development Programme has been set up to assist developing countries in phasing out CFCs and other ozone depleting chemicals.

GREENHOUSE SOLUTIONS

In a recent report, *Technological Responses to the Greenhouse Effect*,

the Watt Committee on Energy has recommended a number of measures to help combat the greenhouse effect.

Aimed at Government and decision-makers in industry, the Watt Committee's recommendations for actions by the year 2000 include introducing higher efficiency power stations burning natural gas; the promotion of wind energy; increased energy production from waste; and a range of energy saving measures for adoption in public and commercial buildings and homes.

The Watt Committee's findings are the result of a year's study by a working group. They will also be submitted to the Intergovernmental Panel on Climate Change which will report on global warming later this year. Contributions to the study were made by professionals from the energy industries, agriculture, forestry and building research.

The measures are aimed at stabilising British emissions of greenhouse gases at 1988 levels until the year 2000. However, the working Group stress the need to be cautious over the efficacy of cost-saving energy efficiency measures in bringing about a sustainable reduction in greenhouse gas emissions. They believe that improvements in energy efficiency could, in the short-term lead to increases in demand for energy which could partially offset the reduction in greenhouse gas emissions achieved.

EURO ENVIRONMENT AGENCY

The final text of the regulation establishing the European Environment Agency has now been published. Its main task will be to record, collate and analyse data on the environment, drawing up expert reports which will

enable both the European Commission and Member States to formulate appropriate policies. A further aim of the Agency will be to develop ways of harmonising measurement and forecasting methods. The Agency's brief will include air, water, soil, wildlife, land use, waste management and noise. The Agency will have a management board which will include two scientists nominated by the European Parliament, two European Commission nominees and 12 national representatives. The Agency's remit will be reviewed two years after the Regulation comes into force. No decision has yet been taken on its location.

IRISH ENVIRONMENT PLAN

The Irish Environment Minister has put forward a national environment plan aimed at dealing with the Republic's air and water pollution. The plan which includes the setting up of an environmental information centre in central Dublin, will end the release of untreated sewage into rivers, lakes and seas around Ireland, and end fish-breeding operations which pollute drinking water. The Irish Development Agency will also encourage "greener" industries through the provision of improved grant aid.

In Dublin where smog levels are regularly in excess of EEC guidelines, a ban on the distribution, sale and marketing of bituminous coal in built up areas will take effect from October. However, sales of peat — which is not considered a smokeless fuel in other countries — will still be allowed.

Smoking

The Irish Government has also put into effect (from May 1990) strict controls

on smoking in public places. Smoking has been banned in all public offices, schools, colleges, supermarkets and stores, cinemas and theatres, trains buses, airports, ferry ports, bus and railway stations, restaurants, health premises, libraries and art galleries. Offending smokers risk a fine of up to Ir. £100 and owners or managers of places where smoking is illegal could face a fine of up to Ir. £500 for failing or refusing to enforce the law.

CLEANER CITIES

EC Environment Commissioner Carlo Ripa di Meana is sending a discussion paper to leaders of all major towns and cities as well as professional bodies in the EC seeking views on future policies to clean up the urban environment. Priorities for action are identified as urban transport and planning, management of wastage and water, and conservation of energy. The Commission intends to organise a series of meetings to discuss the Green Paper leading to a major international conference in early 1991.

ECO LABELLING

The European Commission has now published proposals for a Regulation on Eco Labelling. It is hoped that national experts can agree the draft in time for its formal submission to the meeting of EEC Environment Ministers in November.

An overall objective of the scheme being put forward is to promote the use of products which are less damaging to the environment than other products of the same category. There would be an emphasis on "cradle to grave" assessment, including impact on air, noise, water, waste generation, energy consumption etc. Under the current pro-

posals, it is intended to exclude food, drink and pharmaceuticals from the labelling scheme, as well as products classified as dangerous under EEC rules on the classification of dangerous substances.

The Commission proposes that initial assessment should be at national level, followed by assessment by a "Multi-partite" committee made up of representatives of each Member State, industry, retail, consumer and environmental groups and the European Commission itself.

AIR POLLUTION IN FRANCE

For the first time in ten years, emissions of sulphur dioxide and nitrogen dioxide increased substantially last year. Emissions of SO₂ at 1.33 million tonnes were ten per cent up on 1988 and those of NO₂ increased seven per cent to 1.77 million tonnes. Blame for much of the increase has been attributed to a prolonged drought last summer in France which led to declining supplies of water. This forced Electricite de France to shut down nuclear power plants, because of the risk of them not being properly cooled, and to increase operations at plant using fuel oil and coal.

France is also extending the tax introduced in 1985 for large combustion plant which emit sulphur, to plant which emit nitrous oxide and chloric acid. The tax applies to all plant with a thermal power of 20 megawatts and is expected to bring in approximately F.Fr 2 million annually in tax revenue.

SICK BUILDING SYNDROME

The possibility that our work environment could be the cause of various illnesses ranging from headaches to chest

and gastric complaints, as well as eye complaints and skin allergies, is gaining increasing credence among health workers. Common causes of the sick building syndrome include air conditioning systems, lighting, and vapours given off by office machinery such as photocopiers.

The World Health Organisation has now established a "global alarm system" which will aim to give early notification of materials previously thought harmless but subsequently discovered to be dangerous or a possible hazard in the office environment.

Indoor air pollution is currently under investigation by the House of Commons Environment Committee. The Committee which is expected to report in November is looking at how the design, construction and operation of a building can contribute to its "health", and ways of solving the problem.

LORRY EMISSIONS

The European Commission has followed up its Directive on stricter car emissions (see *Clean Air*, Spring 1990) with proposals for cutting diesel emissions from heavy goods vehicles. The standards being proposed would reduce limits set in a 1988 Directive by 60 per cent. If agreed, Stage I reductions would be effective from July 1992 as follows:

Type approval (expressed in g/kWh): CO 4.5; HC 1.1; NOx 8.0; particulates ≤ 85 kW 0.83 g/kWh and > 85 kW 0.38.

Production conformity (expressed in g/kWh): CO 4.9; HC 1.23; NOx 9.0; particulates ≤ 85 kW 0.7 and > 85 kW 0.4.

Further Stage II reductions, which have not yet been finalised are planned for October 1996; these are, however, expected to be as strict, or stricter than the US 1994 standards being introduced in the USA.

TREES FOR POWER PLANTS

Dutch officials are putting together a plan to plant 250,000 hectares of rain-forest in South America, to compensate for the construction of two new coal-fired power stations in the Netherlands.

The Dutch Electricity Generating Board, SEP, is willing to proceed with the afforestation project, but it wants half the \$20 million annual cost to be covered by revenues from a newly-introduced carbon dioxide tax. This took effect in the Netherlands on 1 February, and is expected to raise \$75 million a year. The power generation sector will pay around \$35 million in carbon dioxide duty. SEP wants the Dutch government to allocate \$10 million annually from this fund for afforestation in South America. It argues that its proposed projects in several South American countries meet the strict criteria set for use of Dutch carbon tax revenues.

Dutch power stations emit 37 million tonnes of carbon dioxide each year — some 20 per cent of total CO₂ emissions in the Netherlands. The two coal stations, each rated at 600 MW, will replace existing plant. The new stations will operate for 25 years and will, according to SEP, emit six million tonnes of CO₂ per year.

INDUSTRIAL NEWS

NEW POWER STATION FOR TEESSIDE

ICI, Enron (a US gas transmission company), and four of the electricity distribution companies to be privatised later this year are backing a project to build a gas-fired power station at ICI's Wilton works on Teesside. The 1725 megawatt plant will be the largest combined heat and power station in the world and will meet 3 per cent of Britain's total electricity demand when it comes on stream in 1993. ICI will take a fifth of the station's output with the distribution boards in the North, Midlands, South West and South Wales taking the rest. ICI and Enron are said to be looking at three other sites in the North West for similar size power stations.

Reader Enquiry Service No. 9017

TYRE POWER PLANT

An American company is hoping to build a £36 million power plant in Wolverhampton which would be capable of producing electricity from burning Britain's scrap tyres. Elm Energy and Recycling (US) Inc, of Connecticut is applying to Wolverhampton Metropolitan Borough Council for planning permission to develop the former Chillington Tool Works at Hickman Avenue, Wolverhampton.

The power station, the first of its type in Britain, would when fully oper-

ational, be able to burn up to half of the 25 million scrap tyres produced in Britain annually. It is planned to provide Midlands Electricity Plc with 20 megawatts of power — enough to supply 20,000 homes.

It is hoped that construction work will begin early next year, with the plant up and running by 1992. Elm Energy and Recycling say the plant would have higher anti-pollution standards than those already in force in Europe.

The scheme has already been welcomed by Stoke-on-Trent-based Retread Manufacturing Association, which says that the power plant will provide an urgently-needed solution to the problem of disposing of waste tyres.

Reader Enquiry Service No. 9018

UK ELECTRIC VEHICLES FOR LOS ANGELES

An Anglo-Swedish company, Clean Air Transport (CAT), has been chosen to supply electric vehicles to Los Angeles, in accordance with their Electric Vehicle initiative.

Los Angeles suffers from particularly high smog levels for much of the year, and among the clean-up measures in hand are requirements for cars to switch to cleaner fuels, and thus reduce exhaust emissions, (see *Clean Air*, Summer 1989).

The initial order is for 1,000 electric

vehicles, and it is expected that production will start in the UK in Autumn 1991.

All vehicles are equipped with an air cooled 34 kW DC motor, an auxiliary power unit (APU) and air conditioning. Electric power is produced by a lead acid battery, which is sealed (meaning no emissions), maintenance-free and long lasting (four to five years). The vehicles are also designed to take sodium sulphur batteries, when these become commercially available. The car will run for more than 60 miles on pure electric power, extended to more than 150 miles when the auxiliary power unit is used. The top speed is 60 mph and the cars accelerate from 0 to 30 mph in less than nine seconds.

Reader Enquiry Service No. 9019

VEHICLE EMISSIONS

The latest report from the European oil industry's environment secretariat CONCAWE is critical of the EEC approach to controlling evaporative emissions from vehicles. *Closing the Gasoline System* recommends measures which CONCAWE considers to be more cost-effective. The European Commission is proposing to control hydrocarbon emissions from cars using small canisters containing charcoal, through which the vehicle fuel system "breathes". Hydrocarbon emissions also arise from the petrol storage and distribution system. The Commission is expected to require controls — called Stage I controls — on the distribution chain from refinery to filling station.

The final source of emissions is the actual point of refuelling at the petrol pump. CONCAWE anticipates that US-style "Stage II" controls may be

required with vapour recovery systems attached to petrol pump nozzles, sucking up hydrocarbon vapour as refuelling takes place. Such systems would be costly for the petrol companies to install and operate. The report argues that refuelling emissions can be more effectively controlled by installing much larger carbon canisters in cars. These can absorb petrol vapour during refuelling and also when the car is running. It also points out that the proposed EEC test conditions for measuring evaporative emissions fail to represent conditions in the hotter European countries (where petrol evaporates more readily) and that the optimum size of canister has been underestimated as a result.

Oil industry sensitivity to concern about benzene is in evidence; the report indicates that a combination of 3-way catalytic convertors plus enlarged carbon canisters would reduce benzene emissions from cars by nearly 90 per cent. It also appears to confirm that unleaded petrol has more benzene than leaded; "European gasoline currently contains on average 2.6 per cent benzene. This level is expected to increase to 3.2 per cent, if all gasoline were to be supplied as 95 octane unleaded grade". However the options of cutting emissions by reducing the volatility of petrol or reducing benzene levels in petrol are rejected on grounds of cost and energy efficiency. Presumably the big canister option would also have the benefit of shifting the costs of emission control from the petrol companies to the car manufacturers!

Reader Enquiry Service No. 9020

BOOKS AND REPORTS

NARROWING THE GAP — GUIDELINES FOR BUSINESS ON ENVIRONMENTAL AUDITING

Available from Publication Sales, CBI, Centre Point, 103 New Oxford Street, London, WC1A 1DU. Price £5 to CBI members, £10 to non-members.

The latest booklet in the CBI's "Environment Means Business" series describes how companies can use environmental auditing to "narrow the gap" and thus make commercial and environmental gains. It sets out clear practical advice to all companies, especially the smaller ones, on how to identify those areas of their business activities which could damage the environment and the improvements which could be introduced.

The booklet also details the benefits auditing can bring to a company. It highlights ways of safeguarding the environment and identifies potential cost savings. It aims to increase employee awareness of corporate environmental policy and responsibility and boost staff morale and commitment to quality. It provides an environmental database to assist management decisions and enables management to set targets and give credit for good environmental performance.

HOW SAFE IS SAFE? RADIATION CONTROVERSIES EXPLAINED

Barrie Lambert. Publisher: Unwin Paperbacks. 1990. £7.99. ISBN 0 04 40347 X

The aim of this book is to examine radiation risks and how we are protected from them. An introductory chapter explains radiation and its effects. Subsequent chapters investigate radiation sources, risks and policies concluding that there must be some level of acceptable risk from radiation and that a more scientifically reasoned approach to radiation risks is required.

THE GREENHOUSE EFFECT: NEGOTIATING TARGETS

Michael Grubb. Publisher: Royal Institute of Public Affairs. 1989. £10.00. ISBN 0 905031 30 X

This paper examines the debate on international negotiations aimed at limiting emissions of greenhouse gases — particularly carbon dioxide. It concludes that unilateral measures may well be crucial in creating the conditions necessary for an effective international agreement. The first requisite of any agreement should be a framework convention, followed by negotiation on international limits. It then examines the available options — carbon taxes, production quotas, systems of tradeable or leasable emission permits.

WHEN THE BOUGH BREAKS... OUR CHILDREN, OUR ENVIRONMENT

*Lloyd Timberlake and Laura Thomas. Publisher: Earthscan. 1990. £6.95.
ISBN 1 85383 082 8.*

The rapid rise in interest in environmental issues and all things green has resulted in a burgeoning industry in books purporting to tell us how to be more environmentally friendly, how to save the ozone layer, combat the greenhouse effect and so on; a good many of the books say much the same thing and once you've read one...

When the Bough Breaks has a different focus. In charting the damage we are doing to our environment, particularly in developing countries, it looks at how this affects children (and indeed women who are still largely responsible for the economic management of families in developing countries). Every year, 14 million children under the age of five die in the developing world (this excludes any "additional" deaths of a drought or famine year); most of these deaths are preventable and most can also be directly linked to the debt crisis facing many developing countries, which can in turn be directly linked to environmental degradation — cutting down of rain forests, inappropriate agricultural development projects etc., to provide an income which can then be used to service foreign debts instead of for internal development — items like clean water, adequate housing and health care, education which most of us take for granted.

Many of the arguments in this book which is clearly written and eminently readable have been well rehearsed by the international consumer movement in its fight for a better deal for Third World consumers — in particular for children (who as this book reminds us are physically vulnerable and politically powerless) to have the right to breathe clean air, drink clean water and eat food free from pesticide contamination. Only when we begin to solve these problems can we make any real progress in solving the wider environmental crisis facing the world today.

1992 EUROSPEAK EXPLAINED

Stephen Crampton. Publisher: Rosters Ltd. 1990. £5.95. ISBN 1 85631 001 9

The year 1992 is indelibly printed on many people's minds as the year "something" happens — although some are probably unclear as to what exactly. For those not quite sure 31 December 1992 is the European Commission's target date for completion of the Single European Market. Already, however, many organisations are floundering under whole forests of EC Literature much of which is written in the "Eurospeak" so beloved of Eurocrats.

This book therefore comes as a welcome and essential addition to reference shelves providing a clear guide to the various EC Institutions and procedures, as well as lobbying tips. Also, more than 500 Eurospeak terms are translated into plain English and finally there is a section on sources of information, which includes a list of European Documentation Centres in the UK.

PESTICIDE RELATED LAW

David Gilbert & Richard Macrory. Publisher: The British Crop Protection Council. 1989. £17.00. ISBN 0 948404 33 7

A very useful summary of pesticide law covering the United Kingdom and European Community. Legislation is indexed by activity and summarised in reverse chronological order. There is also a chapter surveying the complex development of safety policy and control arrangements.

THE LAW OF THE NATIONAL RIVERS AUTHORITY

William Howarth. Publisher: The National Rivers Authority. 1990. £12.00. ISBN 1 872662 00 5

This commentary on *The Water Act 1989* explains the implications of the new law and contrasts it with the old. It sets out to provide a clear and concise summary of the powers and duties of the National Rivers Authority and should provide a useful reference work for anyone concerned with the water industry.

INDUSTRY COSTS OF POLLUTION CONTROL

Ecotec Research and Consulting Ltd. 1989. £15.00.

The report presents the findings of a study commissioned by the Department of the Environment into the costs of pollution control to industry, aiming to estimate costs currently incurred when complying with existing regulations and to review factors affecting future levels of pollution control costs.

HOW TO CONQUER AIR POLLUTION — A JAPANESE EXPERIENCE

Ed. Nishimura. Publisher: Elsevier. 1989. US \$95.00. ISBN 0 444 88537 4

Tokyo was once smog bound — now, while remaining a congested urban centre, the city enjoys “clean” air. This book is the story of the successful fight against air pollution — covering the scientific background and legal controls implemented.

UNLEADED PETROL GUIDE

Autodata. 1989. £2.00. ISBN 0 85666 529 0

A practical guide explaining reasons why unleaded petrol should not be used without knowing its effect on each engine. It sets out the background to the introduction of unleaded petrol and the problems and benefits of its use and compatibility with over 1800 models of car.

INDOOR AIR POLLUTION CONTROL

Thad Godish. Publisher: Lewis Publishers. 1989. £48.55. ISBN 0 87371 098 3

An overview of the indoor air pollution problem, containing discussions of practical control methods for specific contaminants, as well as case histories and policy and regulatory controls.

WASTE MANAGEMENT

OP Kharabanda, EA Stallworthy. Publisher: Gower. 1990. £25.00. ISBN 0 566 09052 X

A practical analysis of the problems of waste handling and disposal — the book covers environmental impact, current forms of disposal, waste management, and reduction of the volume of waste. It is a non technical guide aimed at all those concerned with waste.

INDOOR AIR QUALITY: ORGANIC POLLUTANTS

Publisher: WHO 1989. Sw.fr. 8. ISBN 92 890 1277 3

With the study of organic indoor air pollutants still at an early stage, the report provides an expert assessment of the possible health effects. It looks into the overall impact of these pollutants and identifies areas where information is lacking. The report is based on the results of a WHO meeting held in Berlin in 1987.

PLANT STRESS FROM AIR POLLUTION

Michael Treshow & Franklin K. Anderson. Publisher: John Wiley & Sons. 1989. £39.00 ISBN 0 471 92374 5.

A review and discussion of how air pollution affects plants — covering botanical background, atmospheric processes and the potential effects of air pollutants on plants including economic and agricultural impact.

OZONE DEPLETION: HEALTH AND ENVIRONMENTAL CONSEQUENCES

Robin Russell Jones, Tom Wigley. Publisher: John Wiley & Sons Ltd. 1989. £36.50. ISBN 0 471 92316 8

The edited proceedings of an international conference on Health and Environmental Consequences of Stratospheric Ozone Depletion, held in November 1988. The book is prefaced by a useful fact sheet outlining the chemistry of ozone depletion. It gives an overview of the ozone problem, covering depletion, global warming, controls, health effects and the political aspects of the issue.

EXCHANGE OF TRACE GASES BETWEEN TERRESTRIAL ECOSYSTEMS AND THE ATMOSPHERE

Ed. MO Andreae, DS Schimel. Publisher: John Wiley & Sons. 1989. £50.00. ISBN 0 471 92551 9

The book explores the relationship between trace gases (e.g. methane and nitrogen oxides) and the biosphere. Trace gas exchange is placed in a global framework which examines its relationship to world climate change.

FUTURE EVENTS

18 SEPTEMBER — RISK AND THE ENERGY INDUSTRIES

Consultative conference organised by The Watt Committee on Energy in association with The Institution of Chemical Engineers. The Conference will discuss a draft report drawn up by a working group which has examined how modern methods of risk analysis and hazard management can be applied to the reduction of the risks of serious accidents across all the energy industries.

Venue: Faculty of Arts, University of Birmingham.

Details: Ms G. Oliver, The Watt Committee on Energy, Savoy Hill House, Savoy Hill, London WC2R 0BU. Tel: 071-379 6875. Fax: 071-497 9315.

18-19 SEPTEMBER — WASTE DISPOSAL

Two day conference for health authorities, hospital administrators and officers and councillors, as well as those providing waste disposal services, looking at the *Environmental Protection Bill* and its likely effect on clinical and municipal waste disposal. Fee per single day £100 plus VAT or £180 plus VAT for both days.

Venue: Aston University, Birmingham.

Details: Waste Conference, MPI Group, 4 Hubbard Road, Houndmills, Basingstoke, Hampshire RG21 2UH. Tel: 0256 840444. Fax: 0256 817877.

21-23 SEPTEMBER — THE CHANGING ENVIRONMENT

Two day conference assessing the environmental issues facing the world today. Experts from Oxford University's Environmental Change Unit and from external organisations will present contemporary reviews of key topics and will identify problems, implications and proposals for action. Fee inc. accommodation: £270.

Venue: Somerville College, University of Oxford.

Details: Ms A. Morris, Administrator, Continuing Professional Development Unit, Dept. of External Studies, University of Oxford, Rewley House, 1 Wellington Square, Oxford OX1 2JA. Tel: 0865 270373. Fax: 0865 270708 (CPD Unit — Ext Stud).

21-22 SEPTEMBER — GREENING THE WAY WE GOVERN

Two day conference examining the issues faced by the public sector in the UK and other European countries in determining and executing environmental policy, organising and staffing the institutions responsible and developing and educating public opinion. Fee: £285 RIPA members; £315 non-members; £145 students/academics.

Venue: Royal Holloway & Bedford New College, Egham.

Details: Ms J. Senior, Programme Office, Royal Institute of Public Administration, 3 Birdcage Walk, London SW1H 9JH.

25 SEPTEMBER — WASTE MANAGEMENT: COMING OF AGE

First annual conference of the National Association of Waste Disposal Contractors, coinciding with their 21st anniversary. The conference will focus on the *Environmental Protection Bill* and its likely effect on the waste disposal industry. Fee: Members £175 plus VAT; non-members £200 plus VAT.

Venue: Queen Elizabeth II Conference Centre, Westminster, London SW1.

Details: Ms C. Foxley, Event Planners, 29 Batoum Gardens, London W6 7QB. Tel: 071-602 8115.

1 OCTOBER — ONE DAY CONFERENCE: REGISTERS OF POTENTIALLY CONTAMINATED LAND

It is now clear that there is to be a requirement for local authorities to compile registers of potentially contaminated land. The conference will provide a comprehensive perspective of the subject of contaminated land with particular emphasis on the compilation of registers of potentially contaminated land. Fee: £37.

Venue: The Village Hotel, Hyde, Greater Manchester.

Details: Mike Round, Manchester Area Pollution Advisory Council, Town Hall, Manchester. Telephone: 061-234-4875 Fax: 061-234-5909.

3-4 OCTOBER — EC ENVIRONMENTAL LIABILITY AND COMPLIANCE

Two day conference focussing on the latest developments in EC environmental legislation and how these regulations will impact on business. Fee: £545 plus VAT.

Venue: London Regents Park Hilton, London NW8.

Details: Institute for International Research, 28th floor, Centre Point, 103 New Oxford Street, London WC1A 1DD. Tel: 071-412 0141.

16 OCTOBER — TRACKED URBAN TRANSIT SYSTEMS: NOISE AND VIBRATION ISSUES

This seminar aims to introduce those engineers, planners and contractors who are not experts in noise and vibration, to the issues involved and to review some of the approaches made to address the problem. The seminar is co-sponsored by The Institution of Mechanical Engineers and The Institute of Acoustics. Fee: Members of either sponsoring organisation £90; non-members £110.

Venue: Conference Centre, Chilworth Manor, Southampton.

Details: ISVR Conference Secretary, The University, Southampton SO9 5NH. Tel: 0703 592310. Fax: 0703 592728.

15-18 OCTOBER — 57TH CLEAN AIR CONFERENCE

This year's conference starts with an international theme with speakers from Poland, East and West Germany, Norway and the UK reassessing the acid rain debate and discussing how we in the West can best assist the development of effective pollution control in Eastern Europe. There will also be specialist papers on pollution and noise control, environmental auditing and risk assessment and an evaluation of the impact of the forthcoming *Environmental Protection Act* on local authorities. Fees: Mem-

bers £127 (or £25 per half day) plus VAT; non-members £157 (or £30 per half day) plus VAT.

Venue: Conference Centre, Brighton.

Details: Peter Mitchell, NSCA, 136 North Street, Brighton BN1 1RG. Tel: 0273 26313. Fax: 0273 735802.

16-19 OCTOBER — LANDFILL GAS: ENERGY AND THE ENVIRONMENT

This international conference will take a close look at landfill gas, the technology, the impact of new legislation and the industry which is growing up apace to both control and use it. The conference is jointly organised by the Departments of Energy and Environment and supported by a number of other organisations. Fee: £220 inc. VAT.

Venue: The Moat House Hotel, Bournemouth.

Details (and late registration): Mrs. T. Cone, Conference Manager, ETSU, Building 156, Harwell Laboratory, Oxfordshire OX11 0RA. Tel: 0235 433635.

NEW NSCA LEAFLET

HOUSEHOLD WASTE

Everyone creates waste, and local authorities have a variety of duties relating to waste collection and disposal. This new leaflet provides information about environmental issues surrounding landfilling, incineration and recycling, explains the responsibilities of different organisations in the face of changing legislation, and gives advice about waste minimisation and sources of further information. It should prove useful for answering enquiries about waste disposal, particularly where members of the public are concerned about the effects of existing or proposed incinerators or landfill sites.

Copies of this new leaflet are available at
£3.95 per 100 or £26.95 per 1000

National Society for Clean Air and Environmental Protection
136 North Street - Brighton BN1 1RG

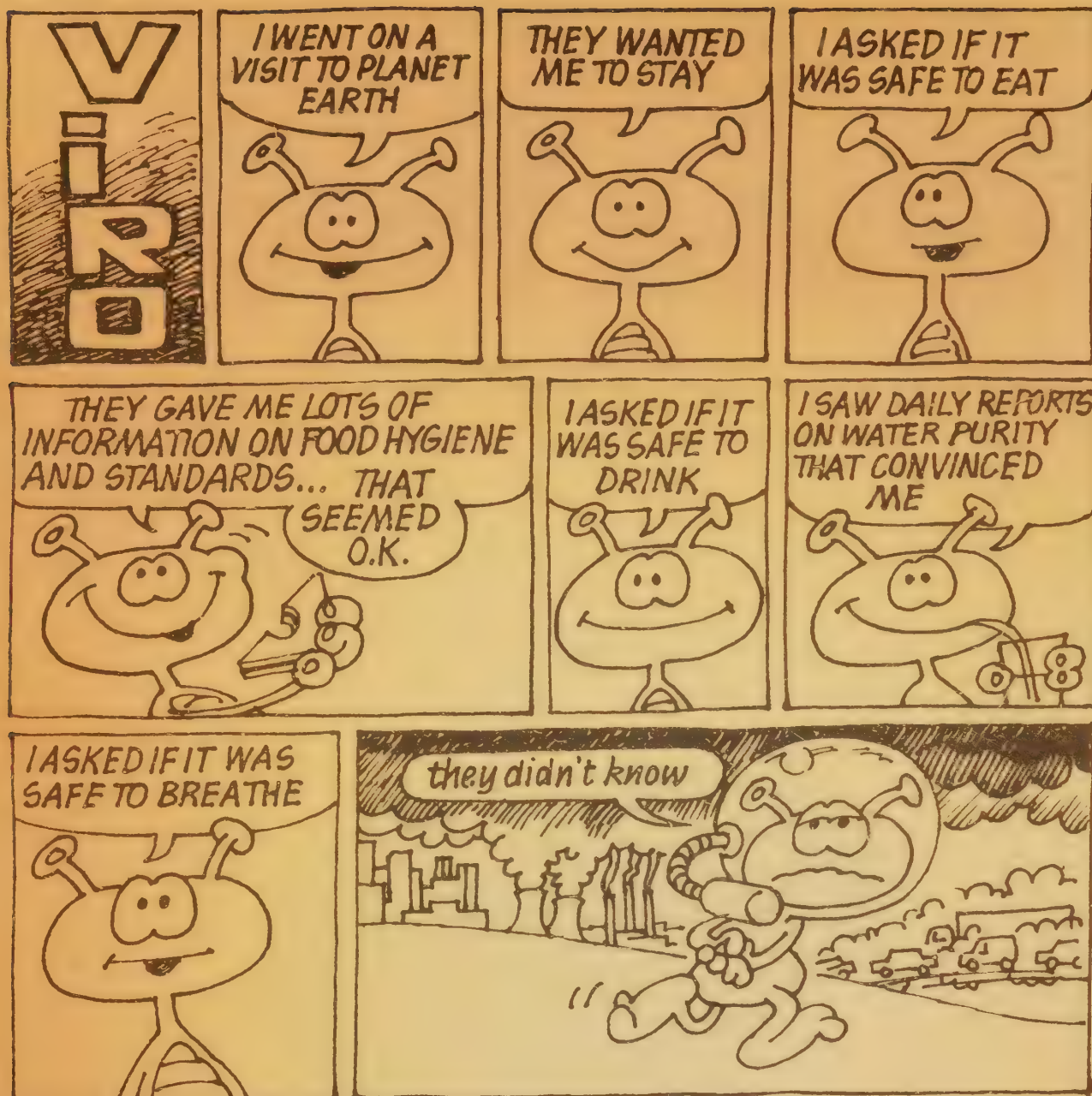
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NATIONAL SOCIETY FOR CLEAN AIR
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VOL. 20 NO. 3
AUTUMN 1990



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EDITORIAL

SAFEGUARDING OUR COMMON INHERITANCE?

That the Government's much heralded White Paper on the Environment was greeted initially by a barrage of criticism was not altogether surprising. Expectations had been raised that the *Environmental Protection Bill* should be seen as the start of the Government's strategy in strengthening its environmental policy and that the White Paper would go on to outline its plans for safeguarding the environment for future generations. Thus when the *Environmental Protection Bill* was criticised for failing to address the "big issues" of environmental concern — pollution from transport, energy conservation and the need for a coordinated approach to environmental policy making — we were told that they would be dealt with in the White Paper.

Sadly the White Paper has failed to deliver. Early indications suggested a major overview of environmental policy and firm proposals for further action at national and international level. In the event, the two central philosophical questions — the integration of environmental policymaking and the use of "green" economic instruments to intervene in the market — were respectively ignored and banished to an Annex.

We would also have expected a greater sense of urgency — most Western Governments now put the environment at the top of the political agenda, not simply because of public concern, but because they do actually believe that action is vital. That requires a degree of policy coordination, plus a degree of economic intervention in order to influence individual and corporate behaviour, which the Government seems unable to accept.

We now have a team in the Department of Environment which appreciates the full extent of the environmental crisis and which wanted to make a serious attempt to develop a range of effective new policies. It is a matter of regret that the full Cabinet Committee appears instead to favour business as usual, given a green gloss in response to public interest. It is clear that many of the more imaginative proposals originally drafted by the DOE have been talked out by the Departments of Energy, Transport and the Treasury.

When the financial implications of effective pollution control became clear, there were understandable worries that the public would find the extra costs unacceptable. Furthermore, issues such as the control of private car use were perceived as interference with personal freedom. NSCA considers that the Government has underestimated the public desire for action, even if there are implications for prices and lifestyles. Increasingly, people are coming to realise that we cannot enjoy our prosperity whilst living in an impoverished environment. Surveys show consistently that people really do want

action on the environment and are prepared to pay for it. The Secretary of State knows this, but he has not yet been able to persuade his colleagues. As a result we have a discussion document stripped of all its radical ideas by entrenched interests.

Thus the White Paper agrees the need to reduce energy consumption — but gives little indication of how the Government plans to intervene, other than by exhortation and voluntary schemes. We have MOT emission testing for cars and hints about a differential road tax for cars — but no commitment to address the overall issue of car use, or to invest in a modern, integrated public transport system. There is a welcome hint of semi-independence for HMIP — but no discussion of a wider role for an Environmental Protection Agency, nor about the coordination of policy between Government Departments. The sections on global warming, acid rain and ozone depletion are merely a restatement of existing policy.

In summary, plenty of well-intentioned words obscuring a small number of useful, though hardly radical, initiatives. A useful overview of current policy, but scarcely a manifesto which sets the agenda for the next century. This was an opportunity sadly missed; as a statement of intent it pales in comparison with the far-sighted approaches being developed by Germany, France, Netherlands, and other countries who see environmental protection as a prerequisite for continued industrial growth. Rather than leading from the front, Britain will once again be clinging to the coat-tails of the EEC as our European partners and the Commission continue to make the running in environmental policy.

Most significantly, the White Paper contains virtually no proposals for new legislation, save in the area of planning law. Is the government now content to rest on its “green laurels”, or does it plan further legislation?

NSCA WORKSHOP
10 and 11 APRIL 1991
Lincoln College - Oxford
BEYOND THE GREEN BILL

Events are moving quickly in pollution control; NSCA Workshops are designed for pollution control specialists who wish to stay in the forefront of developments. The 1991 Workshop discusses the implications for industry and local authorities of the Environmental Protection Act, and looks ahead to requirements which will result from the new White Paper. The UK's experts will be on hand to assess and analyse the future for pollution control in the 1990s.

NSCA NEWS & VIEWS

RCEP STUDY ON EMISSIONS FROM HEAVY DUTY DIESEL VEHICLES

The Royal Commission on Environmental Pollution is to make an increased contribution to discussion of environmental matters, partly by maintaining a closer continuing interest in the subjects of its recent reports and partly by undertaking a new series of studies. The Commission hopes that this will enable it to cover a wider range of environmental issues at any one time than is currently possible and to respond more quickly as issues arise.

The topic chosen for the first study in the new series is emissions from heavy duty diesel vehicles including lorries and buses. It is particularly concerned with the emission of gases and particulates (including smoke), focusing on:

- future emission standards, with particular reference to the proposed EC Directive;
- means of abatement of emissions, including the scope for retrofitting vehicles in service;
- the development and enforcement of standards to be met by vehicles in service;
- quality standards for diesel fuel.

RCEP will take account of the environmental impact of exhaust and other emissions, the scope for their abatement, the pattern of vehicle use and the financial implications of any measures proposed. The RCEP hopes to complete the study early in 1991 and to publish the final report during the first half of that year.

The National Society for Clean Air has argued consistently for tighter controls on diesel emissions. Our evidence outlines briefly why diesel emissions are such a source of concern, and then discusses the two major areas where improvements could be made; firstly in improved standards for new vehicles, and secondly in devising an effective system for detecting and apprehending polluting vehicles which are already in use. Our evidence to the RCEP follows.

CONTROLLING VEHICLE NUISANCE: THE ROAD AHEAD?

The Case for Controlling Diesel Emissions

There are three immediate areas of concern: health, soiling and amenity.

Health: As with many pollutants, whilst health effects can be demonstrated in experimental animals at high doses, the threat to humans from ambient levels of diesel emis-

sions is less easy to quantify. Some epidemiological studies of diesel exposure have shown an increased risk of lung cancer but have failed to establish an unequivocal causal relationship⁽¹⁾. Nevertheless the US National Institute for Occupational Safety and Health (NIOSH) now classes diesel exhaust as a possible occupational carcinogen⁽²⁾, whilst tests on mutagenicity of diesel exhaust point to the smoke fraction as responsible for 80 per cent of mutagenic effects⁽³⁾. In a recent report⁽⁴⁾ the WHO International Agency for Research on Cancer concludes that there is sufficient evidence for the carcinogenicity of whole diesel exhaust in animals, but that the evidence for humans is limited.

As with lead in petrol, a precautionary approach suggests that diesel smoke emissions should be minimised so far as is reasonably practicable.

Diesel engines are also a source of gaseous pollutants, and with tightening emission standards for diesel cars now a certainty, Warren Spring Laboratory has stated that "...heavy duty diesel emissions will become the predominant source of highway NO_x and THC (hydrocarbon) emissions once all future car emissions regulations are in place and this is rapidly becoming a key issue in determining future UK Government policy for emission controls on these vehicles"⁽⁵⁾. NO_x and certain hydrocarbons have direct implications for human health, as well as indirect effects as precursors for the formation of photochemical oxidants such as ozone.

Soiling: According to DOE statistics, road transport is responsible for 34 per cent of black smoke emissions in the UK, compared with 42 per cent from domestic heating⁽⁶⁾. DOE estimated that in the UK 184,000 tonnes of black smoke was emitted by road transport in 1988, of which 92 per cent came from diesel vehicles⁽⁷⁾. Black smoke contains large quantities of elemental carbon and there is strong evidence that diesel emissions are the major source of this pollutant; estimates suggest that they contribute 80 per cent of elemental carbon in Europe⁽³⁾. Elemental carbon is important because of its fine particle size and light absorption characteristics, which make it an exceedingly powerful soiling agent. In urban areas where domestic coal burning is banned diesel smoke will be the predominant source of smoke; research suggests that diesel smoke is responsible for about 60 per cent of the soiling capacity of the air⁽³⁾. Soiling of buildings is aesthetically undesirable, and has a financial cost; a recent study of the UK stone cleaning market suggests an annual turnover of £490 million⁽⁸⁾. In the Netherlands research suggests diesel smoke is responsible for the majority of the cost of soiling there, estimated at £250 million per annum⁽⁹⁾.

Amenity: Diesel emissions are also a straightforward disamenity; diesel smoke and odour can make city streets very unpleasant for pedestrians, householders on major routes, and other road users. NSCA deals with many complaints about diesels; most relate simply to the fact that diesel smoke is very objectionable and contributes to the perception of a poor "quality of life" in urban areas. There is no doubt that the public has perceived diesel smoke as a major nuisance and cause of concern for many years⁽¹⁰⁾. A long-standing complaint has been that the current British and European standards seek only to limit the light obscuration characteristics of diesel emissions to the point where 50 per cent of the population finds them acceptable; clearly, the visibility of diesel exhaust emanating from the exhaust pipe is only one aspect of its unacceptability.

Safety: In addition to these three major areas of concern, diesel smoke can be a safety hazard where vehicles produce so much that they obscure vision on the road. From a global perspective, it has also been suggested that the widespread dispersion of carbon in smoke could affect the overall radiation budget of the planet, with an unquantified impact on global warming⁽³⁾.

Standards for New Vehicles

A new draft Directive on heavy duty vehicle emissions was published in June 1990⁽¹¹⁾. It proposes to tighten existing standards in two steps, and also to introduce a stricter, mass-based, standard for particulate emissions. The first stage reductions are planned for 1992, the second stage for 1996. The proposed second stage standards have not yet been finalised, but the UK Government's position is that they should approximate to the strict "US 1994" standards being introduced in the USA⁽¹²⁾. NSCA welcomes the tough stance being taken by Britain on this point.

The question now is whether diesels can meet US 1994 standards. Doubtless the Commission will seek advice on the technical feasibility of these standards; although NSCA has no direct expertise in this matter, we offer an overview of the technical options as a Note following this evidence.

It has been suggested that in the past the USA has used strict emission standards in order to protect its home market. In a letter to NSCA the Department of Transport (DTp) has pointed out that the USA is able to "roll back" its target dates for compliance if they prove technically impossible to meet. It is less easy to relax environmental standards, once set in EC Directives, should they prove to be unattainable⁽¹³⁾. NSCA does not believe this to be a legitimate excuse for adopting an over-cautious approach to new standards.

US diesel engine manufacturers are confident that US 1994 standards will be achievable soon⁽¹⁴⁾. The adoption of technology-forcing regulations in the US seems to have had the effect of galvanising the manufacturers into action to meet the proposed standards. Despite the formation of consortia amongst European diesel manufacturers to co-operate on research, there is some doubt about their commitment to achieving US 1994 unless the EC forces them to do so. This despite the fact that they are already able to produce engines conforming to the less exacting US 1991 standards for the US market. There is a danger that they will plead for less stringent standards which, in the case of particulates, are already built into the proposed Directive as a fall-back position.

International incongruity of standards would result in European diesel engine manufacturers working to two standards; low emission engines for the US market and higher emission engines for Europe — a nonsensical situation which also arose in the 1980s in relation to car emission standards. NSCA believes that the possibility of less severe standards may tempt European manufacturers to relax their efforts; it should be made clear from the outset that if the US can meet 1994 standards, so should Europe.

The Problem of Existing Diesel Vehicles

It must be noted that the sophisticated design changes required in order to meet stringent emission limits will only work as long as the control systems are properly main-

tained. Standards for new vehicles must be reinforced with an effective method of testing in-use vehicles to ensure that they continue to meet standards.

Furthermore, the comparatively slow turnover of diesel engines — which tend to have a longer life than petrol engines — will mean that the new standards will only result in a slow improvement in overall emissions. The EC should therefore consider a subsidiary set of emission standards for existing, older engines, which would be achievable by retrofitting equipment at a periodic engine rebuild.

Research has shown that the public perceives smoke from diesel vehicles to be a major source of nuisance⁽¹⁰⁾. This is confirmed by DTp statistics; random checks of HGVs in 1988 found that 3.6 per cent were emitting excessive smoke⁽¹⁷⁾. (As noted above, “excessive smoke” refers to visibility at the exhaust pipe and takes no account of other environmental factors.) In answer to a Parliamentary Question in 1989, the then Transport Minister Robert Atkins added that “If that were reflected in the vehicle fleet as a whole approximately 20,000 heavy goods vehicles might be producing excessive smoke in Great Britain”⁽¹⁸⁾. In recent years the percentage of smoking lorries detected at such checks has been around 6-8 per cent, which would suggest that Mr Atkins estimate of 20,000 may be only half of the true figure.

The prosecution rate for offences is low; only 647 prosecutions were made by police for offences relating to smoking vehicles in 1986⁽¹⁷⁾. Since then the Home Office has ceased to collect data on prosecutions for diesel smoke. Neither does the DTp collect data on the number of vehicles banned by its Inspectors for smoke defects.

Official figures on the extent of the smoking diesel problem are thus hard to come by — but daily experience leaves the public in no doubt that the nuisance is real, and widespread.

In July 1990 NSCA circulated its discussion paper *Controlling Nuisance from Road Vehicles*⁽¹⁹⁾ to a number of organisations with responsibility for motor vehicle pollution control. The paper was also reproduced in the last edition of *Clean Air* (Summer 1990).

The NSCA paper noted that, whilst emission standards for new vehicles are improving, once vehicles are on the road there is inadequate control of smoke and noise pollution. At present this is a grey area, falling between the police, environmental health officers and the Department of Transport Vehicle Inspectorate (who are largely concerned with HGVs and PSVs).

For smoky vehicles — predominantly heavy diesels — the police, who have powers to stop vehicles, will only prosecute if the amount of smoke produced is a road safety hazard; however, they have no wish to be involved in air pollution matters. In letters to NSCA, both the Home Office and Association of Chief Police Officers have said that the control of general smoke pollution from road vehicles should be the remit of environmental health departments. However, local authorities who have responsibility for local air pollution have no powers to stop vehicles or to control emissions from road vehicles. The police also appear reluctant to enforce noise controls without an agreed method of measuring noise levels.

NSCA's discussion paper concluded that the existing framework for controlling pollution from in-use road vehicles is inadequate. The three "contenders" for overall responsibility are EHOs, police and DTp Vehicle Inspectors. There is no consensus that local authority EHOs should be involved in this sort of work, although there is a clear link both to trading standards and pollution control activities. An alternative would be to make the system the responsibility of the police or DTp vehicle inspectors, but these bodies might not be able to prioritise such work and may be less responsive to local demands. In many other countries, police and local environmental control agencies co-operate in spotting defective vehicles, usually on the basis of visual assessment or simple technical measurement. There is a strong argument for giving EHOs power to control nuisance emissions from vehicles, particularly where nuisance can be assessed relatively simply.

The Society is also keen to see an expanded role for the DTp Vehicle Inspectorate, since it is clear that the current level of spot-checks is failing to have an impact on emissions of diesel smoke. Consideration should also be given to the regulation by Trading Standards Officers of motor traders, who could be required to sell only motor vehicles which meet the necessary emission standards.

NSCA consulted the Department of Transport, the Department of the Environment, the Traffic Committee of the Association of Chief Police Officers, and the Institution of Environmental Health Officers. Their views are given below.

The **Department of Transport** said that it was "...examining ways in which the rules on smoke from heavy diesels can be tightened and made easier to enforce". It confirmed the recent decision to introduce an annual check on vehicle emissions in the MOT test. In its circular on this proposal the Department says the emission standards which must be met at MOT "...will be incorporated into Construction and Use Regulations. . . This will enable authorised persons from both the police authorities, and from the Department's staff to undertake spot-checks of vehicles on the road. . . Powers already exist for spot-checks of goods vehicles and bus and coach exhaust emissions and these will be extended to cover cars and light vans. . . Heavy Goods vehicles (HGVs) and Buses (PSVs) are already tested for smoke emission, both at the time of the annual roadworthiness test, and at spot-checks on the road. Revised and more exacting methods of emissions testing these vehicles will also be proposed in the future."

The discussion paper drew an enthusiastic response from the **Department of the Environment**. Minister David Heathcoat-Amory said that he was most interested to read the paper, agreeing that "...we do need some means of compliance over the whole time vehicles are in use. It is for this reason that recent amendments to the Vehicle Construction and Use Regulations impose a duty on the owners of vehicles to ensure that emission standards are maintained. The issue now is that of enforcement, and means of improving it are being considered, including the use of better methods of measuring smoke levels".

Although the Department of Transport mentions the role of police, the response of the **Association of Chief Police Officers** to NSCA was not encouraging. Noting that the police have enforcement responsibility for the Construction and Use Regulations,

and powers to stop and check vehicles, the Association added: "Police prosecutions are usually embarked upon when there is adequate evidence that a vehicle, or road, was obscured by such an amount of smoke so as to cause danger. Other than this sanction, the police have no other involvement in environmental aspects — which is in the ambit of environmental health officers. The Service does not possess any technical aids to measure emissions. . . You are probably aware that the Department of Transport are currently consulting (on) a system of in-use testing involving the police. The latter proposal would involve a technical input, presumably by the DTp, with police assistance. . . the environmental aspect of the recent proposal is supported, but, unfortunately, the DTp have not indicated what equipment will be required for roadside testing, or which agency should operate or provide it". On noisy vehicles, the ACPO states that ". . . the measurement of excessive noise of motor vehicles is not technically possible, the Service having no enforcement device available".

Some local authorities are showing considerable interest in possible involvement in vehicle emission control, but in its response to NSCA the **Institution of Environmental Health Officers** expressed "strong reservations" about the concept: "At a time when many local authorities are under considerable financial restraint the scheme would increase pressure on existing resources with only limited foreseeable benefits. . . the view of the Institution is that, whilst there is undoubtedly a problem with regard to vehicle emissions. . . the answer must surely lie in strict control over a number of pollution and noise parameters at the design stage and in enlarging the framework that already exists for regular testing of vehicles. . . a way forward in terms of interim offences may be a referral system to the police who would require an interim test certificate upon complaint by a local authority enforcement officer, or indeed, one of their own officers".

NSCA considers the comments from the DTp to be positive and we await the Department's detailed proposals with interest. In particular, the establishment of "official" MOT emission testing stations lays the foundation for a system for checking in-use vehicles which are suspected by pollution control officers of causing excessive pollution. It is encouraging to find both the DTp and DOE speaking with one voice on this matter, acknowledging the existence of a problem and the need to do something about it. However on their own, annual checks at the MOT will not be enough; experience in the UK⁽²⁰⁾ and US⁽²¹⁾ shows that emissions from vehicles on the road tend to be considerably higher than those measured at annual MOT (or biennial "Smog Checks" in the US). The extension of spot-check powers to include cars and vans, and the proposal to develop better measurement methods for smoke are both welcome. Despite this, a consensus has yet to emerge about who should be responsible for enforcement.

As mentioned above, in many other countries, police and local environmental control agencies co-operate in spotting defective vehicles. Detection of defective vehicles "in the field" could be based on a subjective visual/aural assessment, for instance an observed emission of visible smoke for ten seconds. Alternatively, portable testing equipment is available which can measure gaseous emissions⁽²¹⁾ and noise levels⁽²²⁾ accurately.

We already have precedents for co-operation between police forces and environ-

mental health departments in this area. Experiments involving the Derbyshire constabulary and local EHOs in measuring motorcycle noise have proved very effective, whilst trading standards officers already work with police in checking axle weights on HGVs. However, neither the ACPO nor IEHO appear to welcome any expansion of their role in this area. However several local authorities are considering setting up pilot “smoke-spotting” programmes and at least one — in Derby — is already under way.

In fact, the “way forward” suggested by IEHO is not dissimilar to that outlined in the original NSCA paper, which cited an Australian system where both EHOs and police officers were involved in “spotting” defective vehicles and requiring them to be checked at official testing stations. Such a task could equally be undertaken by DTp Inspectors — in a sense the question of responsibility for enforcement is secondary; NSCA’s primary concern is to see effective controls introduced and fully enforced. Given adequate resources and an appropriate regulatory framework, any of the three potential control agencies could take on the responsibility. What is needed now is a firm indication from Government of which agency — or combination of agencies — it considers most appropriate for the task.

Conclusions

The problem of pollution from heavy duty diesel vehicles was identified by Lord Beaver as long ago as 1954. Yet, of all the pollution problems associated with road vehicles, heavy diesels have received little attention in comparison with light duty petrol and diesel cars. The time has now come for road diesel emissions to be effectively controlled.

For new vehicles, the EEC should not seek a uniquely “Euro-solution” which is less stringent than the US standard. US manufacturers will soon be capable of meeting US 1994 standards, and international trade in diesels will require European manufacturers to catch up if they are to continue to compete in the US market. The sulphur content of diesel fuel will need to be reduced for current technical solutions to be effective.

Recent proposals by the Department of Transport set a framework for controlling in-use emissions from road vehicles, including diesels. However it is clear that the existing system for identifying polluting vehicles is inadequate, and a consensus has yet to emerge about which authority should be responsible for the detection of offending vehicles and for enforcing the necessary remedies.

Note: An Overview of Technical Options for Emission Reductions

Taking a naturally aspirated diesel engine as a baseline of 100 per cent for particulate emissions, turbocharging the engine with intercooling will produce an emission reduction of about 40 per cent, and with more sophisticated controls of the injection process a further decrease of 25-30 per cent in particulates becomes possible⁽¹⁴⁾. As such reductions are made, the contribution from lubricating oil to particulates becomes more significant. This is partly because of anti-acid components in the oil which counteract the effects of sulphur, and explains why low-sulphur diesel fuel is a prerequisite for further particulate reduction.

External means of reducing particulate emissions centre around the particulate (exhaust) trap. Traps usually consist of a filter in the exhaust stream, physically trapping the particulates. Collection efficiencies vary between 50 and 90 per cent⁽¹⁵⁾. Some have a catalytic function, burning off particulates as they are collected. Sulphur will poison the catalyst — a second reason for requiring low-sulphur diesel fuel. The alternative design of trap uses an electric heater to burn off particulates which have been trapped. The market acceptability of such a solution has yet to be demonstrated.

Whilst these solutions for the reduction of particulate emissions are viable, the next problem is to achieve them at the same time as reducing NOx emissions. By oxidising the particulates, higher NOx levels are simultaneously created. NOx reduction requires further work on the injection timing and injector orientation within the combustion cylinder. It should also be noted that there may be an energy efficiency penalty to be paid in order to achieve simultaneous reductions in NOx and particulates.

Alternative solutions to controlling diesel emissions are also emerging. One new technology — the Raprenox process — involves the injection of isocyanuric acid into the exhaust gas stream. Although it is still at the development stage it appears to offer the possibility of effective NOx reduction. A number of fuel additives based on tin compounds also make claims for emission reductions, but these have yet to be fully evaluated and it is doubtful whether they could approach the requirements of US 1994.

The use of alternative fuels such as methanol is also being pursued in the US, particularly where urban buses have to meet the US 1994 standards by 1991. However methanol has a number of undesirable characteristics; it is toxic, absorbs water, and creates other air pollutants such as aldehydes which would need separate emission control technology. From a BPEO perspective, diesel power still appears to be the best candidate provided that effective emission controls are applied.

On the question of sulphur content, the oil industry now accepts the need for low-sulphur diesel as an inevitable corollary of tightening emission standards, and expects 0.05 per cent sulphur fuel to be introduced in 1993⁽¹⁶⁾. Plans to modify refinery capacity accordingly are well advanced.

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LOCAL AUTHORITY AIR POLLUTION CONTROL

The Government has published the first tranche of an expected 70 Process Guidance Notes (PG Notes) to be used by local authorities in granting authorisations to Schedule B processes. While commenting in detail on the PG Note covering clinical waste incineration processes (see below), NSCA also submitted the following comments which would apply to all notes. NSCA's comments on cost recovery charging proposals for local authorities are also outlined.

The draft PG Notes emphasise the importance of referring to ground level concentrations arising from atmospheric emissions. At present there are few statutory air quality limits; NSCA believes that in the absence of other guidelines, the full range of WHO air quality guidelines for Europe should be adopted as the basis for judging acceptability of ground level air pollution. Guidance should be issued by DOE to enable local authorities to enforce control in a systematic and thorough manner.

The current method of estimating chimney height is in need of revision. Simplified computer dispersion models are now available for use by local authorities, and could be made a requirement within a few years. In the interim we recommend that, in line with current advice from Warren Spring Laboratory, minimum chimney heights for chim-

neys over 3 m should be 1.25 times the height of the roof ridge of any adjoining or attached buildings.

Where a requirement appears for continuous monitoring this should be accompanied by a requirement for continuous recording on a chart or printout; such information will be required in order to comply with the requirements for public access to environmental information. Furthermore the monitoring of effects of operations on local air quality should be a specific requirement, rather than simply advisory.

NSCA's most important criticism of the draft PG Notes is the lengthy timescale proposed for upgrading some existing processes — up to ten years in some draft Notes — to bring existing plant up to date. NSCA considers that since tightening standards were predicted as long ago as 1986, we should expect industries to have been preparing accordingly. We urge that existing processes should be able to meet new process standards within a maximum period of, say, three years after the date of implementation of the regulations which schedule the relevant process.

Clinical Waste

NSCA is concerned that the draft PG Note does not consider the incineration of radioactive material. Experience has shown that it is extremely difficult to ensure complete separation of radioactive materials from clinical waste and that, at the very least, some waste presented for incineration will have at some time come into contact with radioactive material. This should be acknowledged in the Note. NSCA also feels that the definition of "process" should also include the word "transportation" as the future trend is likely to be towards centralisation of clinical waste incineration facilities, thus necessitating increased transportation from individual waste producing premises to centralised facilities.

In line with NSCA's general comment on the timetable for upgrading existing plant, NSCA notes that the timetable for upgrading existing processes mirrors that for existing municipal waste incinerators under the relevant EC Directive. However this Directive specifically excludes medical waste from hospitals. Research by NSCA has shown that hospital incinerators, protected by Crown immunity, have an extremely poor environmental record. In view of increasing public concern about the environmental effects of incineration, and the particular problems of clinical waste incineration, we consider the time allowed for upgrading existing processes to be too generous. The impending removal of Crown immunity should in any case have resulted in a review of existing clinical waste incinerators, and we believe it not unreasonable for operators to meet the new process guidance criteria by 1 October 1993.

Cost Recovery Charging

NSCA has already commented in detail on the DOE consultation paper "Cost Recovery Charging for Integrated Pollution Control" (*Clean Air, Autumn 1989*) which outlined proposals relating to HMIP; these views will not be reiterated here. The 1989 proposals also included a single paragraph which sketched the proposed system for local authorities. So far as NSCA is aware, there has been no further official consultation on this matter until the current proposals were circulated in July 1990.

Although it is agreed that the basis for charging for Schedule B processes should be kept as simple as possible, there will in reality be a considerable variety of processes subject to control by local authorities. Whilst such differences will not be as wide as those encountered by HMIP in Schedule A processes, there is some concern that it would be difficult to devise a system which provides a reasonable reflection of the costs incurred by a local authority within a single fee structure.

It is clearly essential that local authorities are sufficiently resourced to undertake their new duties. In general the core charge of £500 per year per process may well be sufficient to police the "average" authorisation, but it must be recognised that most local authorities will have problem plant which may require extensive work in liaison over authorisations or substantial independent monitoring for compliance. In such circumstances £500 is unlikely to approach local authority costs. NSCA therefore recommends that IPLA not only monitors the overall costs incurred by local authorities, but also investigates whether there may be a case for levying extra charges in specified circumstances; particularly where a few plant demand a disproportionate share of the available resources for pollution control.

THE NATIONAL SOCIETY FOR CLEAN AIR AND ENVIRONMENTAL PROTECTION

APPOINTMENT OF SECRETARY GENERAL

The Society is seeking to appoint a SECRETARY GENERAL to manage its affairs in succession to Air Commodore John Langston, CBE, who will be retiring at a mutually convenient date in 1991. The appointment will appeal to a person with experience gained at a senior level and with a commitment to the environment. Interviews will take place in February 1991.

Please write or telephone for further details and an application form to:

The Secretary General
National Society for Clean Air and Environmental Protection
136 North Street - Brighton BN1 1RG

Tel: Brighton (0273) 26313

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SCOTTISH DIVISION

The Scottish Division continues to grow and prosper. Representatives of the Division have now been appointed to the Council and Standing Committees of the National Society. David Munn is now a member of the Finance and Administration and Conference and Promotions Committees; Kevin Thomas has joined the Noise Committee and Calum MacDonald the Technical and Parliamentary and Local Government Committees. The presence of members of the Scottish Division at meetings of the National Society will help to ensure that Scottish interests are fully taken into account in all the Society's work.

In August, the Division held a well attended seminar in Glasgow on air pollution. Presentations were given by Ian McKay of the Solid Smokeless Fuels Federation, Gordon McInnes of Warren Spring Laboratory, Crawford Morgan of Glasgow District Council and George Stott of HM Industrial Pollution Inspectorate. The seminar attracted considerable media attention including widespread press coverage and radio and TV interviews with the speakers.

Forthcoming events include a seminar in Edinburgh in November and the AGM and business meeting on 6 February. The Edinburgh seminar will cover environmental assessment, environmental audit and acid rain. The February meeting will be followed by presentations on transportation pollution.

• NEW PUBLICATION •

The Junior Guide to Air Pollution

In response to the increasing number of enquiries from junior schools about pollution, NSCA has produced a special cartoon booklet aimed at younger children. Each page deals with an air pollution issue, with a simple text and attractive illustration. This should serve as an excellent primer on pollution for all youngsters. 20 pages in colour.

Single copies free - send an A5 SAE, otherwise 70p each
10 to 99 copies 10% discount
100+ copies 20% discount

BRIEFING

THIS COMMON INHERITANCE

On 25 September the Government published its long awaited White Paper on the environment. Much of the extensive speculation on the paper prior to its publication proved accurate with many “proposals to consider thinking” but few commitments for action. And indeed of the almost 350 proposals in the White Paper, a considerable number are either already in hand as a result of the *Environmental Protection Bill* now reaching its final stages or as a result of our commitments to the European Community. However the White Paper does provide a useful record of Government intentions and an agenda for action. The task will be to ensure that the Government uses the White Paper as a starting point for further developing policy and identifying priority issues and develops a timetable for its implementation. In this respect the retention of the Cabinet Committee which drew up the White Paper and the designation of a minister in each department to be responsible for environment policy is hopefully a step in the right direction in ensuring that the needs of the environment are fully taken into account in all aspects of government policy and that action between ministries is coordinated.

This Common Inheritance begins with a reminder that pollution is both a local (or national) problem as well as international and that each and every one of us needs to cooperate to safeguard the environment for future generations. And while policies and actions must be based on best scientific and economic information, this is not a reason for delaying remedial action: “Prevention can often be cheaper and better than cure”. Acknowledging its leading role in environmental protection, the Government summarises its aims as follows:

- to preserve and enhance Britain’s natural and cultural inheritance;
- to encourage the more prudent and efficient use of energy and other resources which global problems demand, and ensure that Britain meets its commitments for reducing global warming, ozone depletion and acid rain;
- to make sure that Britain’s air and water are clean and safe, and that controls over wastes and pollution are maintained and strengthened where necessary; and
- to maintain Britain’s contribution to environmental research and encourage a better understanding of the environment, and a greater sense of responsibility for it.

Issues covered by the 300 pages of the White Paper range from the “street corner to the stratosphere”. Among the proposals of particular interest to NSCA are the following:

Economics and the Environment

The Government acknowledges that it will have to look for ways to control pollution more effectively through the market by using charges, taxes and other economic instruments to encourage consumers and producers to act in ways which do not harm the environment. However, except for transport, increases in energy taxation or other measures to raise energy prices directly are not seen as an immediate option. The White Paper does however raise the possibility that longer term measures to meet internationally agreed carbon dioxide levels "will inevitably have to include increases in the relative prices of energy and fuel. . .by taxation or other means such as tradeable permits". Using economic instruments to control pollution is also seen as a possibility to control acid rain and aircraft noise and the Government also intends to look at an industry based scheme for a levy on tyres to deal with disposal problems.

Energy and Fuel Efficiency

With a view to curbing emissions of greenhouse gases, and in particular carbon dioxide emissions, the Government proposes a number of actions including

- promote measures to encourage people to use energy more efficiently;
- set a target, providing other countries do the same, of returning CO₂ emissions to 1990 levels by 2005;
- introduce competition among electricity generators to give strong incentives for more efficient electricity generation;
- introduce improved thermal insulation standards for new buildings and encourage making buildings more energy efficient;
- set up a new ministerial committee on energy efficiency (to be chaired by the Energy Secretary);
- work towards increasing renewable energy generating capacity to 1000 megawatts by 2000;
- urge the European Community to introduce energy efficiency labelling and minimum standards of efficiency for appliances.

Transport

The White paper proposes measures aimed at making people "aware of the environmental impact of their transport decisions", such as

- better information on fuel economy and good driving practice;
- look at the possibility of changing the taxation of fuel and vehicles to encourage fuel economy;
- extend the MOT test to cover exhaust emissions;
- consider funding for cost effective light railway proposals and to promote measures aimed at making bus transport more attractive;
- support tougher vehicle emission controls at the EC level.

Protection of the Ozone Layer

Following up the commitments made at the Review Meeting of the Protocol held in London in June 1990, the Government intends to contribute up to £9.4 billion over the next three years to help developing countries phase out their use of ozone depleting chemicals, and will also provide aid to India to help it phase out use of CFCs. The Government will press the EC to phase out CFCs within the Community by 1997.

Air Quality

The Government plans to extend and improve arrangements for monitoring of air pollutants and to make this information widely available — including in weather forecasts. It also plans to

- develop “critical loads” for different pollutants;
- base its actions on air quality standards with the advice of a new expert advisory panel;
- press for a new European agreement to control ground level ozone and incineration of toxic waste.

Waste

A number of initiatives are proposed to encourage recycling; these include

- a system of recycling credits, whereby savings in landfill costs are passed on to those who remove material for recycling;
- requiring local authorities to prepare and publish recycling facilities at new shopping developments;
- introduction of environmental labelling which will take account of the recycled content and recyclability of products.

Noise

Further proposals for cutting noise pollution are expected following the Government's consideration of the Department of Environment's Noise Review group. However some of the recommendations from their report are included in the White Paper, including better controls over burglar alarms and car alarms, research into nuisance from night flying, facilitating establishment by local authorities of noise control zones, and the introduction of a pilot “quiet neighbourhood” scheme.

Water

Many of the proposals aimed at protecting and improving the quality of drinking water, rivers and seas arise out of commitments made at the North Sea Conference held in The Hague in March and out of EC commitments. Measures proposed include

- establishing statutory water quality objectives;
- bringing drinking and bathing water up to standard by the mid 1990s;

- raising the maximum fine for water pollution offences to £20,000;
- controlling the use of chemicals which carry health or environmental risks and setting targets for reducing the input of dangerous substances into the sea.

Pollution Inspectorates

The establishment of an independent agency drawing together HMIP and the National Rivers Authority has been rejected; however the Government does intend to strengthen the position of HMIP by making it a separate executive agency within Government and appointing an independent committee to advise it on its responsibilities.

General

Other areas covered in the White Paper include hazardous substances and genetically modified organisms, nuclear power, land use and planning, towns and cities, countryside and wildlife.

This Common Inheritance: Britain's Environmental Strategy, is available from HMSO, price £24.50. A summary is also available, price £2.50.

• NEW PUBLICATION •

NSCA Teaching Pack on the Greenhouse Effect

The fourth in a series of NSCA teaching packs will be published in December. Aimed at the 14-16 age range, the pack looks at the problems and possible solutions to the threat of global warming.

The pack uses the format which has already proved successful in previous NSCA teaching packs; A4 sheets suitable for photocopying, plus teachers' notes, in a transparent wallet.

Pupils are encouraged to sift through a range of information about the sources of greenhouse gases, the possible consequences of global warming and the policies which may be necessary to control them. A role play exercise enables them to explore the policymaking issues which arise. 18 sheets, plus notes.

All four NSCA teaching packs cost £3.00 each inclusive of post and packing. The other packs cover Air Pollution; Noise; Acid Rain.

REPORTS

THE MINIMISATION OF ENERGY WASTE

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Energy Efficiency in Perspective

Energy production and use, especially through fossil fuel combustion are inextricably linked with air pollution, and this has been so throughout history. Brimblecombe (1), for example, related industrial air pollution in 13th Century Britain to fuel changes. More recently the benefits of improved air quality in the United Kingdom since the great smog of 1952 are recognised as due in large part to the improvements in energy efficiency in industry and the conversion to cleaner, more convenient fuels at home, as much as to the legislative climate set by the *Clean Air Act 1956*. Pearce (2) has noted a sense of déjà vu about the current politically high profile afforded to the environment. High on the current environmental agenda, however, is the link between energy and the natural environment. He reminds his readers that all economic activity involves the use of matter and energy, and all matter and energy return in due course to the environment as waste products. Pearce further notes the close relationship to energy use of some of the high priority issues such as global warming, acid deposition and radioactive waste disposal. The wider concepts of a hierarchy of pollution control practice (3) may also be related to energy utilisation, with the first objective being the minimisation of waste.

Global warming has become a major issue, but many uncertainties remain about future trends despite the observations that the 1980s is the warmest decade on record. Schneider (4) pointed out that the uncertainties make it impossible for society to implement programmes to deal with all possible future outcomes, but some actions have additional benefits. More efficient use of energy is one such approach, while the use of less polluting alternative forms of energy to fossil fuels is another. Renewable energy resources have significant environmental benefits, and have recently been discussed in a feature by Phillips & Takahashi (5). The development and expansion of the alternatives to fossil fuels involve national and international planning. So too may the promotion of energy conservation and efficiency programmes, including such options as recycling, the recovery of energy from landfill gas, incineration and other waste streams. Munn (6) developed the theme that incremental resource management should be discouraged. Long term environmental management should concentrate on the development of strategies to cope with the unexpected, but should be integrated.

Owens & Hope (7) have examined the evolution of European policies on the environment and energy, and point to the need for fundamental changes if the two are to

become integrated. The environment policy has progressed from its initial remedial approach to one of prevention and anticipation. Among the many objectives of this policy identified by the authors are the reduction of pollution at source and sound management of resources. The parallel with the hierarchy of pollution control mentioned previously and summarised by Alm (3) is clear. By contrast, attempts to achieve a common European energy policy have met with limited success, and integration with the environmental policy faces conceptual and practical problems. Owens & Hope identify among the energy objectives one aimed at protection of the environment, while improving energy efficiency by at least 20 per cent by 1995 is also cited. Such a move is one route towards reducing global warming but another objective of increasing the market share of solid fuel is in conflict with this. Miller (8) has summarised the current problems at the energy-environment interface in the United States, and includes the key point that the hitherto separate policies must now be combined. Energy conservation and efficiency were again highlighted as areas for action. In the United Kingdom, the House of Commons Energy Committee has regularly noted the lack of emphasis given to energy efficiency in the Government's energy policy. In a recent report (9) it urged intervention to ensure that the vast potential for improved energy efficiency is realised because it is "the most obvious and most effective response to the problem of global warming". While policy problems may be local, the problems are global, and one call for global action (10) proposes a 10 per cent improvement in energy efficiency and energy supply by 2005.

Energy conservation developed a momentum as a result of the oil crises of 1973 and 1979. The driving force then was economics, but now it is environmental issues. Recently many authors have highlighted the need for more promotion of energy efficiency. Everest (11) notes that it is particularly important that efficient energy utilisation is promoted in the developing countries as they undergo industrialisation. Smith (12) developed the thought of an industrial "energy ladder" which society climbs during economic development. Each rung up the energy ladder represents a particular mix of fuel that is generally cleaner than the one lower down. Thus gas may replace coal, as it did in the United Kingdom in the 1950s, or electrification may bring the potential benefits of better control at the power plant. For developing countries it is important to note that scenarios involving improvements in energy efficiency and limiting commitment to solid fuel do not require sacrificing economic growth because energy efficiency produces benefits in economic competitiveness and environmental protection (13,14). Clearly, many of the possible developments require major policy decisions, but a great deal of work to improve energy efficiency relies on the efforts of individual organisations and on individuals within those organisations.

Hannon has enunciated a three tier scheme for energy conservation activities (15). One level involves individual response by substituting different objectives of consumption. For example, reading a book instead of driving a car, or taking a holiday at home rather than taking an international flight both represent the use of income in less energy-consuming ways. They represent individual decisions to change lifestyle for environmental benefits. The second level involves improvements in the efficiency of product use. For example, travelling by bus to town rather than by car, choosing refillable containers rather than throwaway ones, and extensive recycling instead of wide use

of virgin materials. While individual decisions have a role in this level of energy conservation, corporate and government policies must encourage and support them.

The final level of energy conservation involves removal of energy inefficiency through technological change. Actions such as buying more efficient equipment, better insulation of buildings and demechanising certain production activities fall into this category. The pattern of living is least affected by this category of actions, but the impact on energy demand and consumer costs may be significant.

Hannon further examined some energy/economics statistics from the United States. Since 1950 the cost of capital had risen much faster than the cost of electricity. This development helps explain the promotion of off-peak electricity, and also the past tendency not to install adequate building insulation, the trend towards less efficient electric motors and the move towards centralisation in many industries. A further consistent pattern was in the growth in the wage/electricity cost ratio, which had the effect of exerting continuing pressure to substitute electricity for labour. A case study on recycling made it clear that the trend to “throwaways” was more energy demanding and less labour demanding than the option using refillable containers. However, he concluded that reducing energy use was likely to be opposed by the most powerful trade unions, which would be unwilling to surrender high paying jobs so that more people may work and energy conservation be improved. The phenomenon was likened to almost total concern with the present and near complete discounting of the future. Nowadays, further factors have to be included in the considerations of policy makers, including the consumer pressures, the increasing environmental awareness and the international pressures on environmental protection.

The principles of efficiency apply in both developing countries and in developed countries, for the practice in the industrialised countries may have far to go. In the United Kingdom, for example, the Energy Efficiency Office estimates that 20 per cent of the country's energy costs worth £8-billion each year could be saved by improved energy efficiency.

While many authors espouse energy efficiency for the benefits it may bring to environmental protection, the practical steps that an organisation may take to develop an energy efficiency programme can never be overstated. One potential route is outlined here, although a more extensive interactive element in energy management training was recently produced by the author for the UK Department of Energy (16).

The key points in an energy management programme in an organisation are summarised in Figure 1 and some of these points will be outlined.

Leadership

Commitment to energy management must emanate from the very top of an organisation, and this can be demonstrated, for example, by the Board initiating the formation of an energy management committee, and also accounting for energy efficiency in the annual report to shareholders. The energy management committee is the focus for energy use in the organisation, draws together technical and non-technical (e.g. financial and personnel) management, and provides and demonstrates leadership for effi-

cient energy use. The committee can provide an intelligence function, looking to the future for potential pressures or new opportunities for efficient resource management. It can scan the changing social, technological, economic and political world and report on it to the appropriate divisions within the organisation. One of the first steps should be to initiate an energy audit, which asks the question "can energy be used more efficiently?" It proceeds to identify where improvement can be made and what those improvements are.

The Energy Audit

The first component of the audit is to collate existing energy information from the invoices for electricity, coal, oil, gas etc. These invoices are more than accounts to be paid; they may suggest where savings may be made, they produce a record of energy use in a given period which serves as a baseline for future reference, and they may be used to quantify the energy and financial savings made through good energy management. The audit also needs information on process flows and material balances to indicate inputs, products, wastes and by-products (Figure 2). Current or potential recycling may be noted at this point and will be referred to later. Auxiliary services such as compressed air and steam, and water must not be forgotten. The use of water is closely related to energy use, whether through pumping or heating. Water is also expensive in its own right, with a charge for supply and for effluent. Reduction in water use clearly pays dividends not only in the water charges but also in the reduction of pumping and heating costs. The principles of good water management follow those for good energy management, starting with monitoring, minimising leaks and waste, and practising recycling and re-use where practicable. This is, of course, a parallel with the hierarchy of steps in a pollution control programme (Figure 3).

Inspection of the site will enable processes and services to be identified, and an inventory of all energy usage points prepared. This is essential to ensure that data on all these consumers is obtained from past records or during the audit. Potential losses may be estimated at this stage and processes can be related in terms of the potential of energy recovery options or decentralisation of services. Many of the actions to improve energy efficiency are little more than common sense, but identifying them needs a keen eye when a site is inspected. Following this inspection, the energy distribution around the site may be marked on a site-plan, existing metering facilities should be shown and likely sites for additional meters identified.

It is unusual for a site to have adequate instrumentation for the preparation of complete energy and material balances, as meters may have been regarded in the past as an unproductive expense. For the audit, however, they are essential to identify and quantify energy flows to individual buildings and plant, while for continuing good practice in energy management there are advantages in having permanent meters to energy cost centres. Tests on major items of equipment may be appropriate to assess the efficiency of what may be a major consumer on many sites.

At this stage it should be possible to assess the energy consumption by departments and equipment. This preparation of accurate energy and material balances is one of the most important parts of the audit, for without such information it may be impossible to

quantify potential energy savings, and such data are a major motivator for remedial action.

The information gathered and analysed so far in the audit will enable many areas of inefficiency to be identified, and the causes of the energy losses may also be clear. For example, failing to switch off equipment, defective automatic controls, poor commissioning of plant, etc. Quantifying these losses in terms of both energy and cost will focus the attention of those controlling expenditure to deal with the problems.

Improving Energy Efficiency

Potential ways to reduce energy losses and to improve efficiency may now be identified and evaluated against financial and other criteria. Some improvements will be simple and are often termed “good housekeeping” as they involve nothing more than putting right the small faults such as leaks, poor control settings or using excessive temperatures or times in processes. Good housekeeping energy management may be approached by considering the three components, *time, level and efficiency* (Figure 4).

Figure 5 illustrates an application of these component principles to a paint baking oven. In addition to the energy saving potential, the operation of the oven at the optimal temperature for curing the paint has the additional benefit of avoiding odour pollution resulting from thermal breakdown of paint components.

Further ideas for improvements are given in Figure 6. Some of these solutions require small expenditure, perhaps to install new controls where none existed previously, while other improvements may require large sums of money to be spent, as when large plant needs replacing.

Many of the potential improvements on a site have implications for maintenance staff, both in terms of their numbers and training. Likewise, operators and management require training and updating. Staff must know how to use equipment correctly, how to look after it, their role in keeping it operating efficiently, and when to summon specialist maintenance staff in anticipation of a problem arising. Management also need awareness of these principles and their role in maintaining the motivation of staff in energy efficiency throughout the organisation. Some aspects of training for energy efficiency have been discussed elsewhere (17), but as with many areas of training UK organisations lag behind those in other countries. Implementation of the energy conservation plan developed from the audit is not the end of the campaign. Monitoring the effectiveness of the improvements is a continuous process with energy consumption being compared with theoretical values and past performance.

Waste Recovery Options

At around this point in the programme it may be appropriate to consider potential waste recovery options, which may involve both waste energy or waste products.

Heat recovery options come into the major expenditure category of improvements. It is important therefore that no assessment of heat recovery potential is taken until all other improvements have been made; they may reduce the waste heat to the extent that its recovery no longer becomes worthwhile. In essence this is an application of the waste reduction principle widely developing in pollution control strategies.

It may also be appropriate to examine the energy-saving potential of waste materials, whether as potential energy sources themselves or in terms of recycling. Increasingly waste materials such as packaging, straw, wood and other combustible materials offer convenient sources of energy at a local plant level. Stauffer (18) has recently reviewed the recycling option and concluded that significant savings in energy, reductions in carbon dioxide emissions and reductions in water pollution are potential benefits. However, in common with the points made earlier in this paper, it was noted that large scale policy changes must be made before the potential may be realised.

Continuing Energy Management

The energy management campaign outlined here started with the principle that energy efficiency is a management responsibility. Unfortunately, management control of energy use may be ineffective because:

- there is insufficient monitoring providing information;
- there is no index of performance to which energy use can be related;
- there is no clearly defined structure of management to co-ordinate and deal with energy efficiency;
- there may be no mechanism for getting the best operating practice.

One management system for integrating the control of energy into the existing production and financial management of an organisation involves monitoring and target setting. Its aim is to provide rapid and accurate information to all levels of management on the use of energy in the area for which they are accountable. Accountability provides the motivation for them to take action to control energy use based on the information which is regularly provided for them. The energy savings are monitored by the continuing metering system, and so their effectiveness can be measured. Clearly it is necessary to have an energy monitoring system responsive to the consumption of individual departments or units. Data from the audit provides baseline levels of performance and subsequent standards of performance are agreed resulting from determined actions such as improved operational practice, new plant, etc. These intermediate standards are set for the short term with the ultimate goal of meeting longer term targets for energy consumption. The system allows individual energy cost centres to be compared, and even to compete to aid motivation. Clearly all deviations from the standards must be investigated and action taken to eliminate the problem giving rise to higher than necessary consumption. Regular feedback of energy information is essential to all in an organisation, for everyone has a role in the consumption of energy and hence in its conservation to help protect the environment.

Conclusion

The long established links between energy use and environmental protection are gaining increased recognition with many calls for integration of policies. The principles of energy efficiency are often simple, and the strategy matches waste minimisation princi-

ples. Efficient energy management is an important component of an air pollution control programme and involves action by individuals and organisations.

Figure 1: Key Points in an Energy Management Programme

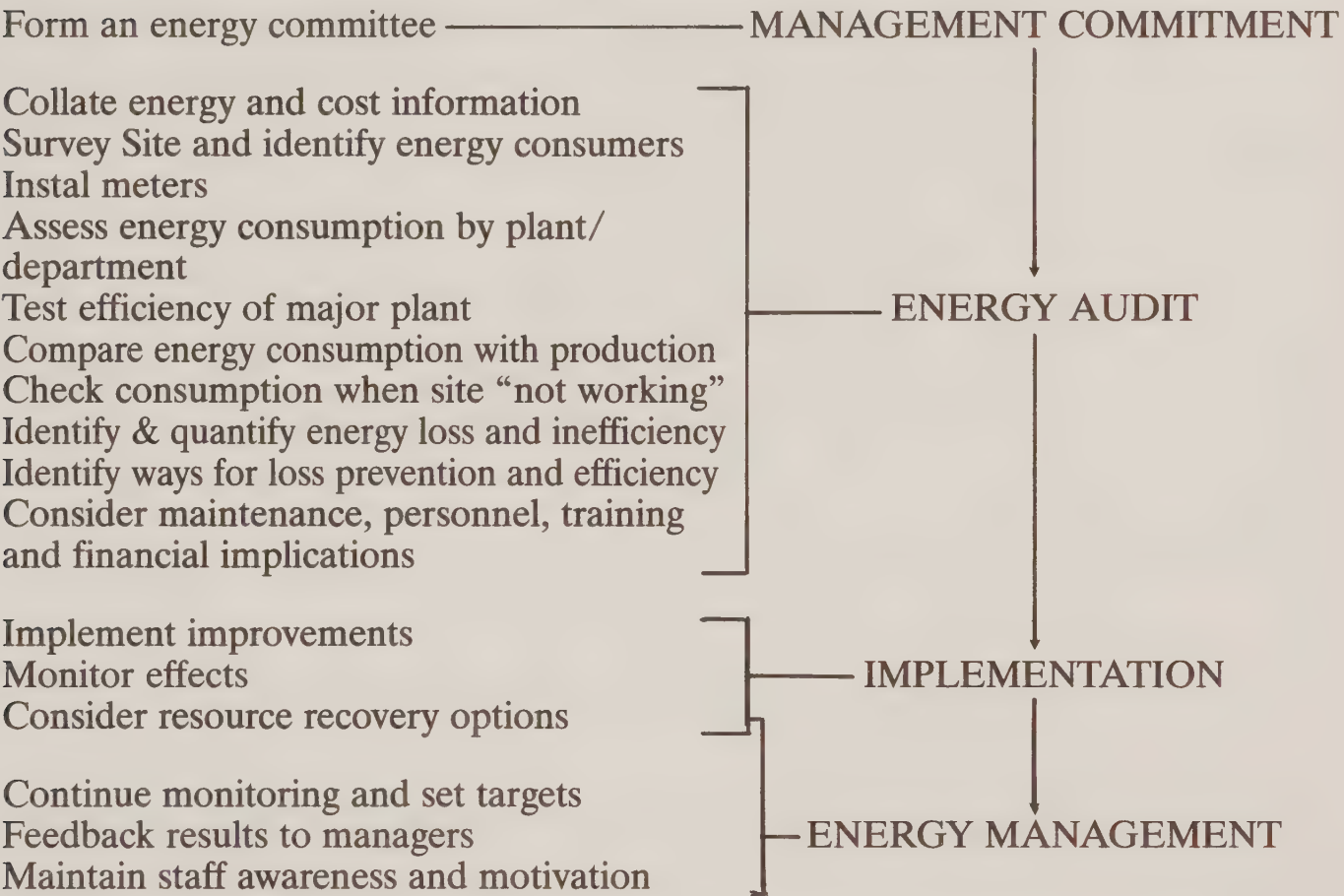


Figure 2: Prepare Flow Diagrams for Processes

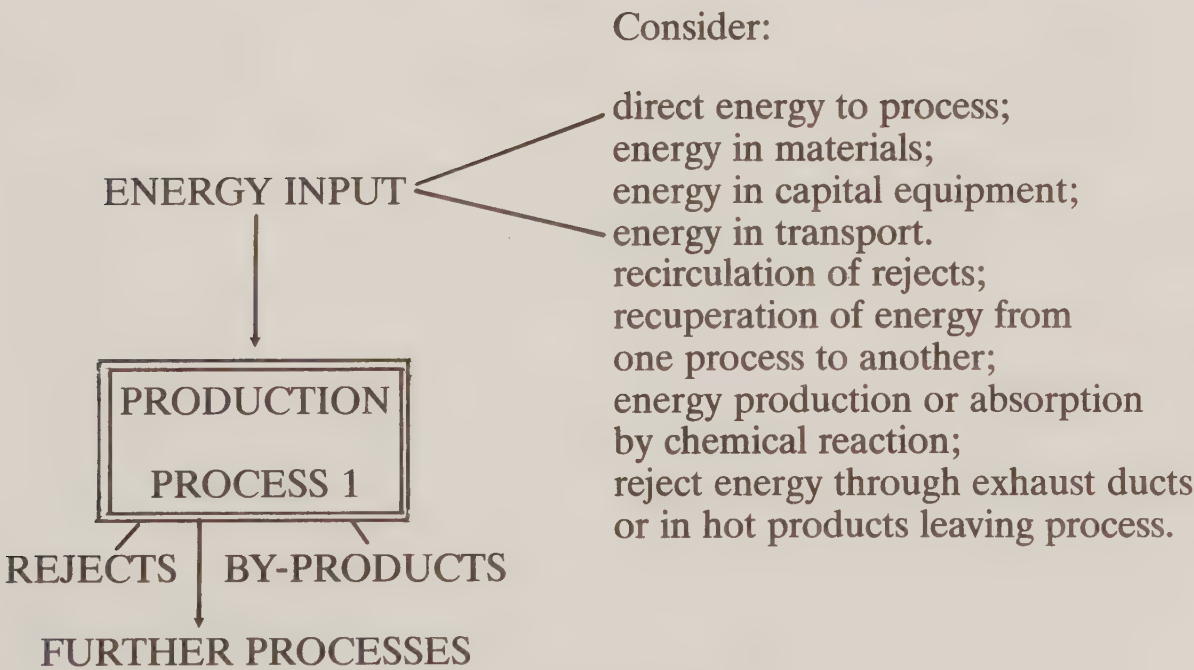


Figure 3: A Scheme for Efficient Resource Management

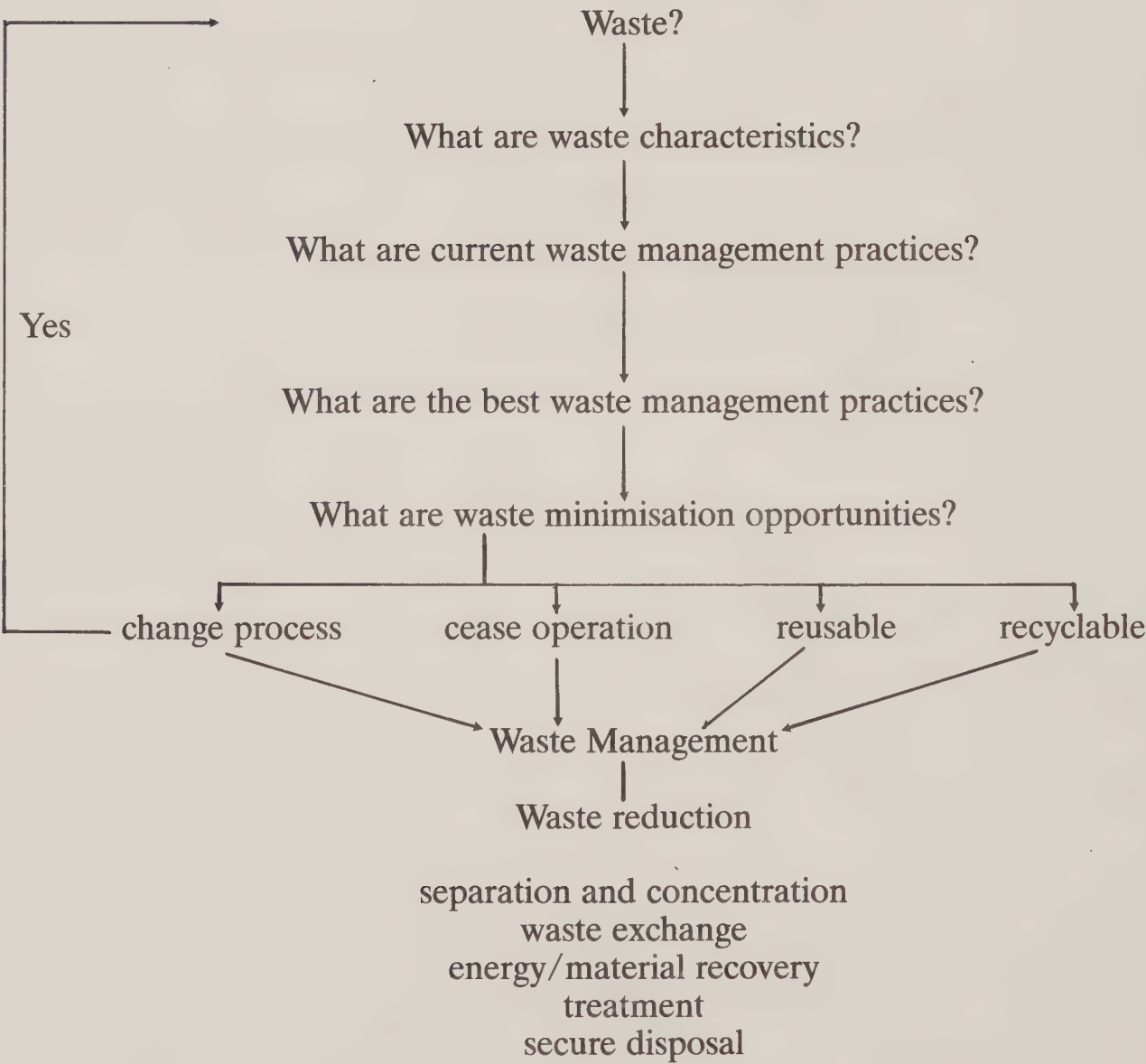


Figure 4: Good Housekeeping Energy Management

TIME - is plant in operation when it could be off?	Examples lights on heating on boiler/furnace on standby exhaust ventilation on with no production
LEVEL - are control levels correct?	steam pressure (the higher the pressure the greater the leak potential) too much lighting compressed air pressure too high oil storage temperature too high refrigeration set too low room thermostat too high
EFFICIENCY — is equipment used to the best advantage at all times?	lighting clean boiler combustion efficiency excessive air entrainment in ventilation dust on ventilator/heater grilles no insulation dirty windows

Figure 5: Illustration of Integrated Energy Efficiency/Environmental Benefits

A variety of products pass on a conveyor from a degreasing plant and automatic paint spraying system to a gas-fired oven. This cures the paint by exposure to a specification temperature of 180° C over a residence time of 10 min.

Problem	Solution	Benefit
measured curing temperature of 215° C	adjustment and better control	1070 GJ/annum saved. Risk of paint odours reduced
production stops at break-times, but oven held at temperature	modify working practice for continuous operation	865 GJ/annum saved
large oven volume allows large volume of air to be heated unnecessarily	reduce size of oven entrance and modify internal structure	845 GJ/annum saved
oven exhaust at 195° C while air temperature to burner is 25° C	heat recovery	air temperature preheated to 150 ° C, saving energy

Figure 6: Investment Opportunities for Energy Efficiency

Typically up to 1 year payback:

Are hot water tanks covered?
 Does space heating have time control?
 Does space heating have thermostatic control?
 Can air/fuel controls be improved?
 Is there potential for condensate return?
 Reduce the size of the cleaning hose nozzles
 Is all heating oil pipework insulated?
 Are all thermal fluid mains insulated?
 Are external surfaces of process plant adequately insulated?
 Are steam traps replaced when necessary?

Typically between 1 and 2 year payback:

Consider oxygen trim control
 Consider economiser on boiler
 Consider power factor correction equipment
 Consider heat recovery from effluents, blowdown etc.
 Recover air compressor heat
 Recover uncontaminated condensate from process plant
 Convert to high efficiency lighting

Typically over 2 year payback:

Examine fuel options
 Install thyristor control on large motors
 Install larger compressed air receivers
 Install maximum electrical demand alarm or control
 Investigate potential for cogeneration

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ENERGY PLANNING FOR REDUCED GREENHOUSE EMISSIONS

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Past President, IUAPPA**

Introduction

The greenhouse issue has aroused wide public interest and is generally perceived as being more of an event than the scientific facts would indicate. Greenhouse gases in the troposphere and the carbon cycle enable man to exist, whilst the use of energy (mainly fossil fuel) enables man to enjoy his present lifestyle. For sustainable development to continue there is no alternative to the continuing use of fossil fuel. For this reason it is important that fossil fuel which is a finite resource should be used most efficiently and for its best purpose, to ensure that associated long term greenhouse gas emissions are minimised.

The Greenhouse Issue

If global warming and associated climate change are to occur in the future, then the cause is man. During this century the world's population has increased from 1.6 billion to over 5 billion people and it is estimated that it will exceed 6 billion by the turn of the century. The expanding population has been demanding of increased goods, services and general conditions, associated with an improving lifestyle. This has resulted in annual energy use expanding from 500 million tonnes of oil equivalent at the turn of the century to over 8,000 million tonnes of oil equivalent being used at present. This large increase in energy consumption has mainly occurred in the developed western world. However, "post the first oil shock" in 1973 the western world's primary energy consumption has remained comparatively static, although an increase in energy use has occurred. Recent increases in primary energy demand have mainly occurred in the non-western and developing countries, where future escalated demand is mainly predicted to take place.

Man can only survive with the aid of agriculture and energy, whilst man's lifestyle is considerably enhanced by the use of many other commodities most of which give rise to various gaseous emissions entering the atmosphere, some of which are radiatively active. These greenhouse gases are principally water vapour, carbon dioxide, methane, ozone, nitrous oxide and the chlorofluorocarbons.

Measurements undertaken at a number of international baseline monitoring stations have shown that the concentration of greenhouse gases is increasing in the troposphere; CO₂ is increasing at about 0.4 per cent per annum, methane at about 1 per cent per annum, nitrous oxide at about 0.3 per cent per annum and the chlorofluorocarbons at about 5 per cent per annum (1). Apart from water vapour, carbon dioxide is the largest single contributor to greenhouse gases entering the atmosphere. However, CO₂ is the least active of the greenhouse gases with the CFCs being more than three orders of magnitude more powerful. In addition methane and the CFCs are increasing into the troposphere at a significantly greater rate than is CO₂. At present non CO₂

gases contribute about 50 per cent to the potential heating from man generated greenhouse gases entering the troposphere annually (2,3). In the future CO₂ will play a diminishing role, whilst in total other greenhouse gases will play an increasingly important role.

Carbon dioxide entering the atmosphere is mainly from natural sources whilst a small component results from the combustion of all fossil fuel and from deforestation and associated land use. It is currently estimated that deforestation, land use and subsequent soil oxidation contribute about one third of CO₂ emissions that come from man's activities (4,5).

Concern over the potential climatic effects of an increase in concentration of atmospheric carbon dioxide and other greenhouse gases were first expressed over a century ago, but it was not until the advent of the computer, that quantitative projections of the possible effects could be made. A number of models have been developed, which although extremely complex, and embracing a wide amount of data, are recognised as being inadequate to accurately predict future change as a result of increasing greenhouse gases in the troposphere. Any scenario derived from use of the models, at their present stage of development, can only be considered to be speculative.

The most widely accepted general circulation models estimate that for a doubling of greenhouse gas concentration in the troposphere the projected mean global temperature increase is in the range of 1.5° C to 4.5° C (6). However recent refinements for the effect of cloud cover in one model, has resulted in halving the previously predicted temperature rise for a doubling of greenhouse gases in the troposphere (7). The importance of improving the reliability of the models to accurately predict, rather than speculate, future events from increasing greenhouse gases, cannot be over stressed.

Bearing in mind the unknown impact caused by the differences in measuring technique and the influence of modification to surroundings of many of the world's temperature measuring sites, the observed global average temperature over the past century has shown considerable variation, incorporating both heating and cooling periods, but overall indicates an increase of about 0.6° C as shown in Figure 1. The calculated temperature rise theoretically caused by the increasing greenhouse gases in the troposphere is also shown in Figure 1 and coincidentally this suggests an increase of the order of 0.6° C might have been expected to occur, but an inspection of the two curves shows that in fact there is no direct correlation. Volcanic activity has been investigated as a possible cause of temperature modification, but again no correlation can be observed. Natural variability of the climate may explain the changes that have occurred. However, solar activity represented by average sunspot number does show, when taken over the past century an apparent relationship (8) as indicated in Figure 1. Obviously a number of factors may have an impact on the earth's temperature, but it appears that solar activity may have a dominating role, whereas past greenhouse gas increases do not appear to be the major influence on temperature change. It is not factual to suggest that the temperature modification during the past century is the result of increased greenhouse gases in the troposphere. Satellite measurements of tropospheric temperature during the past decade confirm that there is no global warming trend in as much that there have been randomly distributed warm and cool years with no indication of a global trend (9).

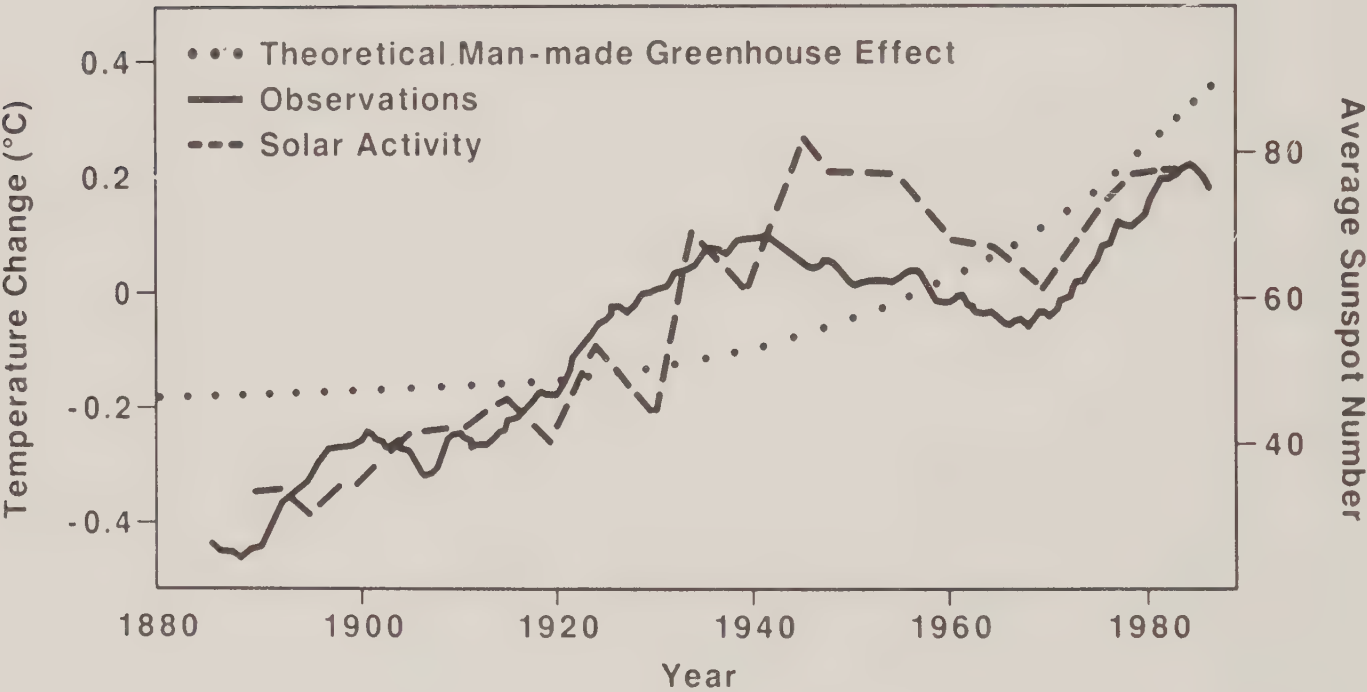
Figure 1

- Comparison between
- a)

Observed global average temperature
- b)

Solar activity
- c)

Calculated theoretical temperature change from increased greenhouse gases



Radiative gases arise from a wide range of sources and the current relative contribution from human activities of each of the greenhouse gases to the potential earth's surface temperature rise is shown in Table 1. This shows that energy use is but one of the contributors.

Energy

Almost 90 per cent of the world's primary energy comes from fossil fuel, whilst the remainder is mainly derived from hydro-electricity generation or the use of nuclear fuel. Currently oil use constitutes about 38 per cent of the world's energy input whilst gas represents about 20 per cent and coal about 30 per cent. Although non fossil fuel sources of energy are being researched and developed, for technical, environmental and economic reasons it is unlikely that renewables or nuclear energy will assume a significantly greater role for the foreseeable future, than the one they occupy at the present. The fact that the world's population will continue to increase and that the developing world will continue to improve its lifestyle, both mean that there will be an escalating need for energy, which must continue to be largely met by the world's reserves of fossil fuel.

**Table 1: Relative Contribution of Greenhouse Gases
Resulting from Human Activities**

Radiative Gas	Percentage Contribution Based On Temperature Rise Potential	Principal Source
CO ₂	50% (15 ±5% (14 ±2% (10 ±1% (5 ±1% (6 ±1%	Deforestation and Land Use. Petroleum. Coal. Natural Gas. Other Fuel and Process
Methane	15 ±5%	Agriculture, Cattle, Biomass Burning.
CFCs	20 ±6%	Aerosols, Air Conditioners, Refrigeration, Plastics.
Ozone	7 ±3%	Motor Vehicles
N ₂ O	7 ±3%	Fertilisers, Biomass Burning.
Others	< 4%	

It is comforting to consider that although human generated greenhouse gas emissions have increased in the troposphere by over 40 per cent in the past century, there has not been a correlateable identified increase in temperature. However, regardless of the uncertainties surrounding the greenhouse issue, we can be certain that fossil fuel reserves are finite, although we may not know the exact extent to which they can be recovered. Nevertheless estimates have been made and we have a good knowledge of proven economic recoverable reserves and these figures are shown in Table 2. Reserves of conventional crude oil and natural gas are each and in combination, significantly less than those of coal. At the present rate of use both natural gas and the conventional crude oil will be exhausted in a number of decades, whereas coal will remain available as an energy source for several hundred years.

The relative life span of these resources is most important when considering greenhouse gas emission control strategies, since present and envisaged technologies dictate that either liquid or gaseous fuels will continue to be required for transport and for commercial and domestic applications where both liquid and gaseous fuel is most convenient and efficient and technically needed, when all factors are taken into consideration. Alternatively coal is most suitable for direct firing installations such as power generating plants, cement kilns, large industrial boilers and for metallurgical purposes. In these larger installations, coal can be shown to be efficient, economic and with the use of currently available technology, to be environmentally clean.

Table 2: World Fossil Fuel Reserves

Fuel	Proven Recoverable Reserves BOE x 10 ⁹	Estimated Ultimate Recoverable Reserves BOE x 10 ⁹
Coal	5000	20000
Conventional Crude Oil	900	2000
Natural Gas	700	1500

Note: BOE: barrels of oil equivalent.

Each form of fossil fuel has a different carbon content per unit of specific energy, such that coal has the greatest, oil slightly less and natural gas the least, as shown in Table 3. However, carbon is not the only component in the fuel that contributes greenhouse gases to the troposphere. Of major significance is the generation of hydrocarbons, oxides of nitrogen and carbon monoxide from the use of petroleum products in transportation. These emissions interact through photochemical action to produce ozone, which is not only a greenhouse gas, but is also a major contributor to air pollution in the world's largest cities and populated areas, with the potential to affect health, vegetation and materials. Also nitrous oxide is produced in small quantities from combustion, with the greatest contribution coming from vehicles and gas turbines.

A significant component of fossil fuel is consumed for transportation and since transportation using existing or envisaged technology will largely continue to demand either a liquid or gaseous fuel, ultimately, and in the not too distant future, there will be an increasing shortage of both petroleum liquid and natural gaseous energy sources. To make up for this, solid fuel (including coal) will be converted to both liquid and gaseous fuels, principally for use in transport. However, these conversion processes will mean that for each unit of energy consumed by the end user, there will be an approximate doubling of greenhouse gas emissions, due to the efficiency losses associated with conversion and there is no foreseeable technology available to dramatically change this situation, as shown in Table 3.

For these reasons it is important to adopt an energy use strategy which ensures that petroleum and gaseous fuel is not wasted in large stationary plants. Since although it might result in a short term reduction in greenhouse gas emissions, it would eventually result in a longer term significant increase in these emissions. Hence it is important that a long term energy policy should be established internationally to minimise greenhouse emissions for the total life of fossil fuel reserves, which ultimately must be considered to be used.

It can be seen from Table 3 that the substitution of natural gas for coal in a large pulverised coal fired power station would result in an approximate 40 per cent reduction in greenhouse gas emissions, whereas if the same gaseous unit of energy were used to

Table 3: Carbon Dioxide Emissions from the Combustion of various Fuels

Fuel	CO ₂ Emission Rate Kg CO ₂ /GJ
Natural Gas (Methane)	50
Petroleum Products	69 - 75
Bituminous Coal	87
Liquids from Coal	145 - 187
Gas from Coal	145
Oil from Shale	175 - 380

replace gasoline for transport a significantly greater reduction in greenhouse gas emissions would occur, due to reduction of both CO₂ and the precursors to ozone formation. In addition and most significantly the use and dedication of gas for transportation rather than in large stationary heating plants would extend the life of both petroleum and natural gas reserves for transport use so that the ultimate need to convert solid fuel to liquid and gaseous fuels for this purpose would be deferred. thus minimising greenhouse gas emissions from the eventual use of fossil fuel reserves. Hence it is of utmost importance that strategies be adopted internationally to direct both natural gas and petroleum to transport use for the long term minimisation of greenhouse gas emissions.

Because of this need it is important to recognise that any tax strategies aimed at controlling greenhouse gas emissions should not embrace either a carbon or CO₂ tax, since they could distort the energy market acting against the higher carbon content fuels for a short term gain and a long term disaster.

Conclusion

Regardless of whether there is a long term greenhouse problem, it is considered prudent to effect measures to minimise any possible impact arising from man’s continuing and expanding activities. Therefore it is important that this strategy should take note of the relative magnitude of the reserves of the various forms of fossil fuel, their ultimate finite nature and the world’s continuing need for fossil fuel. Hence it is important to ensure that short term strategies are not adopted at the expense of future generations. Now is the time for statesmen not politicians.

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UPDATE

INTEGRATED POLLUTION CONTROL

The Government announced at the end of July that integrated pollution control, to be implemented following enactment of the *Environmental Protection Bill*, would not now start to be introduced until April 1991 (instead of 2 January 1991). From that date IPC authorisations will be required for all new IPC processes and for substantial changes to existing processes and for large combustion plant. Other existing processes will be brought within IPC as part of a four-year programme beginning in April 1992. Regulations under the Bill required to implement IPC will cover the processes and substances which come within IPC, appeals procedures, information to be included in public registers, arrangements for making IPC

applications and those to be consulted in determining applications.

The first batch of HMIP guidance notes, covering the five main industry sectors affected by IPC, were to be issued for consultation in mid September and to be issued in final form at the beginning of January 1991. Detailed guidance on individual IPC processes are to be issued for comment in time for promulgation of the final version at least three months before each process is due to come within IPC.

Local Authorities

Under Part I of the *Environmental Protection Bill* local authorities will be given new powers to control air pollution from a range of prescribed processes. Twelve thousand mainly industrial processes (and an estimated 15,000

small waste oil burning appliances) will require an authorisation from a local authority (District or Borough Council).

The authorisation must contain conditions which achieve a number of objectives, including the use of best Available Techniques Not Entailing Excessive Cost (BATNEEC) to prevent and minimise air pollution. Technical guidance notes on what constitutes BATNEEC for each category of process are being drawn up by the DOE's local authority unit in consultation with relevant industry groups, local authorities and the HMIP/local authority liaison committee. As at mid-September drafts of eleven process guidance notes had been issued for consultation, covering clinical waste incineration; extraction of non-ferrous metal from scrap; blending, packing, loading and use of cement; glass manufacture; lead glass manufacture; ceramics manufacture; animal rendering; maggot breeding, fur breeding, manufacture of timber and wood based products; and the chemical treatment of timber and wood base products.

NSCA's comments on the general content of the PG Notes and on proposals for local authority charging for authorisations (see below) are reported on under NSCA News and Views.

Cost Recovery Charging

Final details of the Government's proposals for cost-recovery charges to meet the costs of HM Inspectorate of Pollution and the national rivers authority in administering IPC to be introduced as from April 1991, have also been published, as well as outline plans for local authority charging.

For IPC authorisations, it is proposed that operators will pay an application fee for each authorisation, and an annual charge for each authorisation process, to cover the ongoing costs of compliance monitoring and enforcement. Charges will be linked to the number of defined "component" within the process. Thus large and complex plants, with more components, will pay more than small businesses.

Subject to detailed estimation of next year's costs, the application fee is likely to be around £1,800 per component. The annual charge is likely to be around £400 per component in addition to which processes which involve discharge to controlled waters will also pay an element to cover the cost of water monitoring and analysis, based on the NRA's charge tariff for equivalent processes.

It is proposed that all Part B processes under local authority control will pay a flat-rate application fee of around £800, and an annual charge of £500, except small waste oil burning appliances, paying reduced rates — application fee £200 and annual charge £100.

The proposals for the *Radioactive Substances Act* (RSA) charging scheme also follow consultation on outline proposals. Premises subject to RSA control range from Sellafield to factories using small radioactive sources. For charging purposes, premises are divided into four "Bands". Sellafield and major nuclear installations such as power stations (Band 1 and 2) will be charged individually for time spent. Band 3 premises (eg hospital or university laboratories) would pay an application fee of around £1,050 and an annual charge of around £400, and Band 4 premises (eg

factories and other holders of minor radioactive sources) an application fee of around £280, and an annual charge of around £85.

SMOKE CONTROL

The Solid Smokeless Fuels Federation report that attention to environmental issues has led to renewed interest from local authorities in completing smoke control programmes. In their 1989-90 Annual Report, the SSSF say that the UK programme of smoke control is likely to continue at its present level until April 1993 with some 100,000-150,000 houses each year coming under smoke control orders. The Federation is also supporting the Department of Environment to ban the sale — and therefore use — of unauthorised fuels (including petroleum coke) in smoke control areas.

GOVERNMENT BACKING FOR CLEAN POWER PROGRAMME

A new project for cleaner, safer power generation, and costing £379,000, is to be undertaken by the Combustion Centre at Harwell Laboratory. The Department of Energy will provide the funding for the two-year project as part of its Clean Coal Research and Development Programme. The Combustion Centre, part of AEA Environment and Energy, will investigate ways of reducing the environmental impact of power generation by modifying combustion processes to restrict harmful Nox emissions which contribute to acid rain.

Using laser technology and mathematical modelling, the project will help develop anti-NOx techniques and demonstrate them on an industrial scale. Modification of the combustion process offers a potentially cheaper anti-pollution option than emission clean-up.

Such techniques are expected to prove attractive to the UK's power generation and boiler manufacturing industries in particular. Results from the research will be disseminated to industry, research organisations and universities throughout the United Kingdom.

GAS FIRED POWER PLANT FOR NORTH EAST

National Power has placed an order with NEI ABB Gas Turbines Ltd. for a 650 MW, turnkey, gas-fired, combined-cycle power plant in Killingholme, Humberside. The plant will comprise three gas turbines and a steam turbine, and will take three years to construct. The Killingholme power station is one of the first in a series of a new generation of combined-cycle power plants planned in the UK.

GREEN ASSESSMENT FOR BUILDINGS

The first "green" assessment scheme for buildings, which will enable developers and their clients to influence the environmental impact of their buildings, was launched by Environment Minister David Trippier in July.

BREEAM, the Building Research Establishment Environmental Assessment Method, was developed by BRE in collaboration with The ECD Partnership and sponsored by property developers Stanhope Properties, Olympia and York and Greycoat, together with Sainsburys. It is an assessment method for awarding an "environmental certificate" to new building designs. It provides recognition for buildings which are more environmentally friendly than buildings designed to the best normal practice.

The assessment covers a range of design aspects affecting the global, neighbourhood and internal environments. Credits are given for aspects which meet specific targets. The first version of the scheme, which applies to new offices, includes:

- *global issues* — global warming, ozone depletion, rain forest destruction;
- *neighbourhood issues* — Legionnaires' disease (from air conditioning), local wind effects, re-use of existing site;
- *indoor issues* — Legionnaires' disease (from water supplies), lighting, indoor air quality, hazardous materials.

The scheme is voluntary and is carried out on a fee-paying basis by independent assessors approved by BRE. Assessments are carried out at the design stage, so that suggested improvements can be incorporated into the final design. A certificate is issued on confirmation of the final design.

More details of the scheme are available in the BRE publication: *BREEAM 1/90 — an environmental assessment for new office designs* available from the BRE; Garston, Watford, price £15. Other versions are planned to cover other building types.

UN CONFERENCE ON THE ENVIRONMENT

The problems of the environment and of international sustainable development will be the central issues addressed by a major UN conference to be held in Brazil in June 1992. The conference will be a follow up to the World Commission on Environment and Development (The Brundtland Commission), which published the 1987 report to the UN

Our Common Future. The conference will also mark the 20th anniversary of the 1972 Stockholm Conference on the environment which led to the setting up of the UN Environment Programme.

At the first organisational session for the conference held last March in New York, it was agreed to urge countries to form national committees to prepare for 1992. The UN is organising regional conferences in Africa, Asia, Europe and Latin America to help focus these efforts. Overseeing the arrangements will be Maurice Strong, who chaired the Stockholm Conference and was the first Executive Director of UNEP.

The UN has appointed working groups to tackle various issues. The first will consider protection of the atmosphere from such problems as depletion of the ozone layer, protection and management of land resources against deforestation, desertification and drought, conservation of biological diversity and environmentally sound management of biotechnology.

The second working group will look at the protection of fresh water, oceans and seas and the environmentally sound management of waste.

Both groups have been asked to take into account consumption and production, technology, financial and human resources, food security, and the eradication of poverty.

A third working group to be set up will look at the issues of institutional, legal and related matters. A voluntary fund is also to be established to help developing countries participate in the preparatory process.

The 1992 conference is also

expected to look at strategies for international cooperation, methods of financing technology transfers, development of environmental education, law and the exchange of information and an examination of the role of the UN in improving the environment. (*Pratap Chatterjee in Development Forum, UN Department of Public Information*)

TREES AND AIR POLLUTION

Results of a survey carried out last year for the UN Economic Commission for Europe and covering two-thirds of the forest area of Europe show significant damage to trees thought to be caused by pollution and insect attacks. In Britain 28 per cent of mature oaks and 33 per cent of mature beech trees show moderate or severe leaf loss (although not as bad as in 1988). The report says that trees in more than half of the 26 participating states and regions "are in a precarious state of health", and it calls for further action to reduce emissions of sulphur dioxide and nitrous oxide both of which contribute to acid rain.

NEW VOLVO PAINT SHOP WILL CUT POLLUTION

In 1991 Volvo's "environmentally responsible" paint shop will start operations at its Torslanda plant. By combining water-borne paint technology with new air-recirculation and filtration methods, Volvo aims to preserve the quality of its surface finish while reducing the emission of solvents by at least 80 per cent — and thus also provide better working conditions for its employees.

The water-borne paints, pioneered by Volvo in collaboration with ICI, contain less than a quarter of the solvents used in normal, solvent-borne paint: a difference of special importance for the

50 per cent of European cars which now have a metallic finish. With conventional processes, applying a clear metallic coat over the coloured base coat of paint nearly doubles the emission of solvents. However, the penalty of water-borne paint is a tenfold increase in drying time: Volvo's conventional paint shop in Gothenburg consumes nearly three million cubic metres of air per hour. By contrast, automatic spraying stations at the Torslanda plant will have a recirculating system which reduces air consumption to less than 10 per cent of the previous level for the same performance, with a major saving in energy.

RADON

The National Radiological Protection Board has recently published a broadsheet on radon in its "At-a-Glance" series. As with others in the series, this broadsheet is intended for readers with no knowledge of the subject. Radon and its potential problems are explained through illustrations and captions rather than text. It describes the characteristics of radon, how it builds up in homes, the nature and level of the risks, and remedies and preventative measures; finally it summarises the problems posed by, and solutions to, radon in the workplace. Single copies or small quantities are available free of charge from the Publications Office, NRPB, Chilton, Didcot, Oxon OX11 0RQ.

POWER FROM REFUSE

Cory Environmental has been looking at eight sites in the London area for developing a 80-100 MW power station fueled by rubbish. The company is seeking approval for its plans, under the Non Fossil Fuel Obligation levy set up by the Government to encourage alternative energy schemes in the privatised elec-

tricity industry. When operating the plant would turn one million tonnes of rubbish into electricity each year.

ENVIRONMENTAL CONSULTANCY INDUSTRY EXPANDS

The new Environmental Data Services (ENDS) Directory of Environmental Consultants lists 225 environmental consulting organisations — an increase of 80 per cent since the first (1988) edition. According to ENDS research, the growth in the industry has been driven partly by legislation — particularly Directive 85/337 EEC, which came into force in July 1988, requiring environmental impact assessments for major development projects. ENDS predicts that with more new legislation, particularly the *Environmental Protection Bill*, setting specific environmental standards for many industrial sectors for the first time, the trend is set to continue. This, coupled with the explosion of public interest in environmental issues in the late 1980s, has prompted many companies to reappraise their activities — resulting in environmental auditing growing from an obscure activity to over 5 per cent of the consulting industry's workload. The Directory details companies' main areas of work and appendices give an at-a-glance guide and regional guide.

Directory of Environmental Consultants, 1990, published by ENDS, £40.

PRACTICAL GUIDE TO ENVIRONMENTAL POLICY-MAKING

In support of its Business and Environment Programme, the Environment Council together with 3M United Kingdom PLC have produced a simple step

by step menu of guidelines for managers on how to formulate and implement an environmental policy. Entitled *Integrating Environment into Business — A Guide to Policy Making and Implementation*, it aims to present a coherent and effective response to growing environmental pressures on business. It will assist organisations in implementing systems which ensure that they can manage the many legislative, attitudinal and behavioural changes that will affect their business operations and overall profitability now and in the future.

The guide contains a number of examples of how other organisations have benefitted from such policies and demonstrates that the environment cannot merely be dealt with by a corporate "green guru": it is the job of every manager — of every employee — to understand the environmental implications of what they are doing.

Staff involvement and commitment are also essential prerequisites to devising and implementing an environment policy. Key staff need to be identified and briefed on the business and environmental agenda. Another prerequisite is that an environmental policy first has to be good for the business, otherwise it may be at risk of being abandoned as soon as it faces the reality of commercial or other pressures within the organisation.

For more details of the Guide and of the Environment Council's Business and Environment Programme, contact Steve Robinson on 071-278 4736.

BOOKS AND REPORTS

ENVIRONMENT AND HEALTH THE EUROPEAN CHARTER AND COMMENTARY

Copenhagen, WHO Regional Office for Europe, 1990, (WHO Regional Publications, European Series No. 35) ISBN 92 890 1126 2. Price: Sw.fr. 26. Order No. 1310035.

The First European Conference on Environment and Health, held at Frankfurt-am-Main, Federal Republic of Germany on 7 and 8 December 1989, brought together ministers and other senior representatives from the environment and health administrations of 29 European countries and from the Commission of the European Communities.

The Charter, which was adopted by the final session of the Conference, is a further extension of the European health for all policy and targets adopted by the 32 member States of the European Region of WHO in 1984. It also incorporates the basic philosophy of the World Commission on Environment and Development, and represents a major step forward in the development of both public health and environmental policies at a time when political change is greatly enhancing cooperation among Member States throughout Europe. By adopting the Charter, the governments of Europe have taken a united position on the basic principles, mechanisms and priorities for further developing environmental health programmes.

CITIES ARE GOOD FOR US

Harley Sherlock. Publisher: Transport 2000. 1990. £8.00. ISBN 0907347134.

The author, a leading urban planning architect, sets out to demonstrate that the decline in quality of the urban environment can be attributed to misguided housing and transport policies. Using London as his model, he refutes arguments that urban congestion is caused by dense population, too many people working in the city centres and insufficient roads. There are fewer people working and travelling in cities than 20 years ago, but increased use of private cars has led to increased congestion on roads, declining bus services and overcrowded rail networks. Expanding suburbs, out of town shopping centres, and subsidised company cars all encourage movement away from local jobs, shops and services, making longer journeys necessary and increasing congestion, fuel consumption and air pollution inevitable. Subtitled 'The case for high densities, friendly streets, local shops and public transport' he argues that the benefits of city living should be easy access to a variety of facilities. If populations become more dispersed and people have to travel further, it will be to the detriment of the countryside as well as the urban environment. Thought provoking background reading for anyone involved or interested in urban or transport planning.

INTEGRATED POLLUTION CONTROL IN EUROPE AND NORTH AMERICA

Ed. Nigel Haigh and Frances Irwin. Publisher: The Conservation Foundation, USA and Institute for European Environmental Policy, London. 1990. £15.00.

ISBN 0 89164 117 3.

This book is a result of a joint project by IIEP and the Conservation Foundation. The project, begun in 1986 and concluding in November 1988 with a symposium, grew out of a recognition that conventional methods of controlling pollution of water, air and soil, etc separately were no longer appropriate; the promulgation of integrated pollution control in various forms in Europe and the USA was seen as the way forward for dealing with pollution at the local and national levels, and indeed at international level.

Integrated Pollution Control in Europe and North America reviews the development of the integrated or cross-media approach to pollution control in the USA and Canada, followed by case studies in the Netherlands, FR Germany, Sweden and the UK. It examines the various approaches to IPC and evaluates the options for achieving it both at a policy level and institutionally.

The introduction of integrated pollution control in the UK next year following the enactment of the *Environmental Protection Act* will make this book of particular interest to those readers wanting to look in detail into the background of this method of control and how it has worked in other countries. It is a pity, therefore, that the time lag between the conclusion of the project and the publication of this book in mid-1990 means that the UK chapter was unable to take into account the development of IPC following the government's 1988 consultation paper, and indeed the form of IPC as it appeared in the *Environmental Protection Bill*.

STATE OF THE WORLD

Worldwatch Institute. Publisher: W.W. Norton. 1990. \$9.95. ISBN 0393306143.

Founded in 1975, the aim of the Worldwatch Institute is to inform policymakers and the general public about the interdependence of the world economy and its environmental support systems. This annual report on progress towards a sustainable society covers many facets of environment and development, with chapters written by Worldwatch researchers covering air and water pollution, agriculture and poverty and focusing on the major policy initiatives needed to sustain the world as we know it.

SICK BUILDING SYNDROME — CAUSES, EFFECTS, CONTROL

Publisher: The London Hazards Centre. 1990. £4.50. ISBN 0948974060.

For some time the causes and effects of sick building syndrome (SBS) have been a matter of contention for office workers and employers. This informative book provides a useful reference point when assessing a problem. It covers symptoms and possible causes and outlines modes of investigation, remedies and prevention and is an interesting read for anyone concerned or involved with the syndrome.

FASHIONABLE WASTE — THE MAKE UP OF A RECYCLER

J. Forshaw, A. Hay, G. Wright. Publisher: Save Waste and Prosper Ltd. 1990. £4.50. ISBN 0951617303.

The first of two reports describing public attitudes to recycling — using the results of surveys carried out in Leeds. It examines the motivation behind the public to recycle and the facilities that would encourage recycling. A useful publication for anyone involved in the promotion and setting up of recycling schemes.

OZONE DEPLETION, GREENHOUSE GASES AND CLIMATE CHANGE

National Research Council. Publisher: National Academy Press. 1989. £17.15. ISBN 0309039452.

Proceedings of a symposium held by the National Academy, Washington DC, investigating the link between ozone depletion, emission of greenhouse gases and climate change.

PRINCIPLES OF AIR POLLUTION METEOROLOGY

T. Lyons, B. Scott. Publisher: Belhaven Press. 1990. £25.00. ISBN 1852930799.

An introduction to the techniques and models used in the analysis and modelling of air pollution. The polluting effects of major industrial chemicals are discussed along with impact assessment techniques. A handbook for researchers and advanced students.

ENVIRONMENTS AT RISK — CASE HISTORIES OF IMPACT ASSESSMENT

Derek Ellis. Publisher: Springer-Verlag. 1990. DM 68.00. ISBN 3540511806.

This volume uses the Canadian experience in environmental management as a basis. With an introductory chapter explaining the concept of risk and assessment, the book examines various case histories including acid rain, city sewage and Bhopal. The final chapter discusses issues arising from the cases assessed.

SOURCEBOOK ON THE GREENHOUSE EFFECT

E. Ellis, J. Devine. Publisher: Institution of Mechanical Engineers. 1990. £23.50. ISBN 0852987447.

A guide to the increasing volume of organisations, technical literature and reports on the greenhouse effect including conferences, databases and a list of references indexed by author and keyword. Current to 1988.

OZONE CRISIS

Sharon Roan. Publisher: John Wiley & Sons Ltd. 1989. £12.65. ISBN 0 471 61985 X

Subtitled “The 15 Year Evolution of a Sudden Global Emergency”, the book explores why it took so long for the destruction of the ozone layer by man made chemicals to be taken seriously by industry and government.

NITRATE POLLUTION AND POLITICS

J. Conrad. Publisher: Gower. 1990. £25.00. ISBN 0566071479.

The book summarises the debate concerning nitrate pollution of ground and drinking water in Britain, West Germany and the Netherlands. The scientific background to the nitrate problem is set out, followed by a discussion of the extent of the pollution problem in the three countries and their political approaches to regulation.

THE ENERGY ALTERNATIVE

W.C. Patterson. Publisher: Boxtree. 1990. £16.95. ISBN 1852832843.

Based on a television series, and aimed at the lay reader, the book is a lively and interesting introduction to the energy which is essential to all aspects of our lives, and that we have long taken for granted. It sets out what we use energy for, how we do it and how we might do it better, and contrasts the pros and cons of traditional energy sources with the problems and promise that the alternatives present.

BRITISH STANDARD CHARACTERIZATION OF AIR QUALITY

Available from BSI, Linford Wood, Milton Keynes MK14 6LE.

BS 6069, Section 3.1. This publication deals with the method for the determination of vinyl chloride using a charcoal tube and gas chromatograph.

BS 6069, Section 4.1. This deals with the method for the determination of the mass concentration of sulphur dioxide: hydrogen peroxide/barium perchlorate/thorin method.

FUTURE EVENTS

31 OCTOBER — GREENHOUSE OR GREEN HOUSE: LOCAL ACTION TO TACKLE GLOBAL WARMING

The conference will highlight ways in which local authorities can act to minimise the impact of the greenhouse effect with the agenda focussing on the role of energy efficiency as one of the most effective ways of reducing greenhouse gases. Fee £80 + VAT for statutory/private sector and £50 + VAT for voluntary sector and charities.

Venue: Civic Centre, Newcastle upon Tyne.

Details: Sara Williamson, Conference Services North East, North East Farm Cottage, Great Whittington, Northumberland. Telephone: 0434 672307.

7 NOVEMBER — NRA AND WATER QUALITY MONITORING

One of a programme of evening meetings (1800-2030) organised by the Institution of Environmental Sciences. Mr. T. Reeder of the NRA will be the speaker. Cost £1 for refreshments.

Venue: Ove Arup & Partners, Adam House, 1st Floor, Southampton Room, 1 Fitzroy Square, London.

Details: Alastair Baillie, 23 Bradford House, Kingswood Estate, West Dulwich, London SE21 8NZ. Telephone: 081-670 5377.

8-9 NOVEMBER — ENVIRONMENTAL ASSESSMENT

The introduction of regulations on environmental assessment in July 1988 represented one of the most significant changes to the planning system in years. The conference will give advice on drawing up a better environmental statement, look at the interaction between environmental assessment and the new integrated pollution control regulations and consider the role of public participation in the EA process and how it can be of benefit to the developer. Case studies with representatives ranging from local authorities and environmental consultants to industry sharing their technical experience, will be presented.

Venue: Café Royal, London W1.

Details: Liz Hide, IBC Technical Services Ltd, 56 Holborn Viaduct, London EC1A 2EX. Telephone: 071-236 4080. Fax: 071-489 0849.

13-14 NOVEMBER — THE A-Z OF CORPORATE RESPONSIBILITY AND HOW TO SUSTAIN ENVIRONMENTAL EXCELLENCE

Conference highlights include developing the right environmental strategy, formulating and developing company audit systems, the role of the environmental manager, securing public acceptance of the company stance and winning local authority and business cooperation. Fee £626.75.

Venue: Regent Crest Hotel, London W1.

Details: IIR Ltd, 28th Floor, Centre Point, 103 New Oxford Street, London WC1. Telephone: 071-412 0141.

13-14 NOVEMBER — THE AUTOMOTIVE INDUSTRY AND THE ENVIRONMENT

International conference covering practical measures of exhaust gas and noise emissions, fuels of the future, alternative fuels, proposals for recycling materials from old vehicles, alternative schemes of traffic management and their effect on pollution levels and traffic flow, etc.

Venue: Intercontinental Hotel, Geneva.

Details: Helen Conry, Environmental Matters, 43 Manchester Street, London W1M 5PE. Telephone: 071-224 1876. Fax: 071-224 4961.

20 NOVEMBER — THE ENVIRONMENT WHITE PAPER 1990

This conference is a joint initiative between Wildlife Link, and the Nature Conservancy Council with additional funding from WWF. Speakers will look at international initiatives to save the planet, environmental taxes, structures for nature conservation, energy and pollution, European law etc. Fee: £75/£40 for NGOs.

Venue: St. William's College, York.

Details: Wildlife Link, 45 Shelton Street, London WC2H 9HJ.

Telephone: 071-240 9284.

22 NOVEMBER — ENGINEERING ENERGY EFFICIENCY

Issues to be addressed include the contribution of energy efficiency to a successful enterprise, true costs and benefits, the elements of an effective energy policy, waste reduction and energy efficiency as an essential element in total quality management. Fee: £365 + VAT.

Venue: Queen Elizabeth II Conference Centre, London.

Details: The Fellowship of Engineering, 2 Little Smith Street, London SW1P 3DL.

Telephone: 071-222 2688.

29-30 NOVEMBER — ENVIRONMENTAL AIR POLLUTION UPDATE

Two day course, organised by the Centre for Continuing Vocational Education dealing with the range of issues of concern in the field of atmospheric air pollution. The emphasis will be on alerting delegates to the impact of new control requirements on their own organisations.

Venue: University of Sheffield.

Details: Mrs. K. Wainwright, University of Sheffield, CCVE, 65 Wilkinson Street, Sheffield S10 2GJ. Telephone and Fax: 0742 768653.

26 NOVEMBER — THE ENVIRONMENTAL PROTECTION BILL: IMPLICATIONS FOR LOCAL AUTHORITIES

The *Environmental Protection Bill* will introduce new concepts to pollution control and change the distribution of responsibilities and powers between central government (represented by HMIP) and local authorities. This seminar, organised by London Scientific Services, will include speakers from both central and local government, and will also cover specific pollution topics.

Venue: Strand Palace Hotel, London.

Details: George Vulkan or Claire Nathan, LSS, Great Guildford House, 30 Great Guildford Street, London SE1. Telephone: 071-962 9884. Fax: 071-962 9885.

5 DECEMBER — ENVIRONMENTAL IMPLICATIONS OF A SINGLE EUROPEAN MARKET

The onset of the Single European Market (SEM) has diverse implications for environmental management throughout the European Community and certainly will spur even more widespread environmental regulation. What will be of equal interest will be the consequences of countries inspiring regulatory standards, one of which will be the impediment of equal flow of goods and services across member state borders. The loss

of customs and the movement of the products of endangered species is another concern of SEM. This conference offers an opportunity to examine the gains and losses for the environment and will be of particular interest to those members of industry who wish to increase their awareness of the consequences.

Venue: London Press Centre.

Details: Liz Hide, IBC Technical Services Ltd, 56 Holborn Viaduct, London EC1A 2EX. Telephone: 071-236 4080. Fax: 071-489 0849.

CALL FOR PAPERS MEASURING AND MONITORING OUR ENVIRONMENT

In October 1991, The Institute of Measurement and Control, in conjunction with Teesside Polytechnic and Middlesbrough Borough Council will be holding a major international conference in Middlesbrough.

The conference is intended to bring together industrial management, instrument manufacturers, instrument users, university researchers and environmental monitoring and protection officers to discuss aspects of measurement and monitoring and to debate possible future developments.

Papers for the conference are invited on all aspects of measurement and monitoring of waste disposal sites, the atmosphere, rivers and shorelines and the likely impact of new European legislation which deals with the subject. The deadline for receipt of abstracts is 31 December 1990. Authors will be notified of provisional acceptance by 31 January 1991, and the deadline for receipt of full texts is 31 May 1991.

NSCA LEAFLETS

A selection of explanatory leaflets on topical subjects
Sample copies available on request

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CLEAN AIR

NATIONAL SOCIETY FOR CLEAN AIR
AND ENVIRONMENTAL PROTECTION

VOL. 20 NO. 4
WINTER 1990

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BEYOND THE GREEN BILL

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Lincoln College, Oxford

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NATIONAL SOCIETY FOR CLEAN AIR AND ENVIRONMENTAL PROTECTION

(Founded 1899)

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EDITORIAL

BALANCING THE BOOKS

If, following current trends, The Environment were to be privatised, the company's annual report for 1990 would certainly show sustained — almost feverish — activity. Production of words is considerably up over previous years — but has the output of deeds been able to keep pace?

The balance sheet shows some notable achievements. On the credit side we have a new *Environmental Protection Act*, without doubt the keystone to a comprehensive and sophisticated pollution control system. The environment White Paper, although composed largely of recycled material, does at least provide a wide-ranging checklist of Government policy on green matters. Significant advances have been made in many fields and this Society can modestly claim to have influenced several: tightening emission controls for motor vehicles; the ban on straw and stubble burning; improved public information on air quality; a radical review of noise legislation. International activities also show some promising developments, with a tightening of the timetable for banning production of CFCs and other ozone depleting substances.

Turning to the debit account we note that local authorities and HMIP may lack the resources — though not the will — to implement the EPA effectively. The Government still has to act decisively on controlling emissions from in-use motor vehicles and is cavilling over the standards to be adopted for MOT testing. The question of controlling acid emissions from large combustion plant seems likely to enter another period of controversy. Imaginative and environmentally responsible waste disposal schemes will continue to be dogged by the NIMBY syndrome.

Looming over our national preoccupations comes the issue of global warming. Delegates at the Annual NSCA Conference heard a gloomy assessment of the chances of reaching an effective and equitable agreement on greenhouse gas emissions. Meaningful reductions could cost the industrial world — and the consumer — dear, and politicians would only sanction such measures with overwhelming public support. In times of financial stringency environmental policy may be seen as a luxury; recently voters in the USA decisively rejected a series of new “green” laws largely on grounds of cost. Here in the UK too, concern about environmental issues appears to be moving down the opinion poll league tables as the recession bites.

The green tide may be turning. Can The Environment plc keep its head above water in the face of economic problems and wavering public interest? Lest the company directors become too complacent, we, the shareholders must continue to demand that the books balance. If they do not, the loss will be measured in more than simply pounds and pence.

NSCA ANNUAL CONFERENCE**EASTBOURNE****21-24 OCTOBER 1991****CALL FOR PAPERS**

Every year the NSCA Conference addresses a wide range of environmental issues, covering the fields of air pollution, noise, waste disposal, energy policy and more.

If you are undertaking research or have particular experience in environmental protection which could be of interest to a varied audience, you might like to consider presenting a paper to the 1991 Conference at Eastbourne.

We invite potential authors to submit one-page proposals summarising the scope of the paper along with its title, the name of the author, his/her affiliation and a contact address and telephone number.

Proposals should reach NSCA at the address below by 1 March. Authors will be notified in April.

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NSCA CONFERENCE

NSCA CONFERENCE 1990 — AN EYEWITNESS ACCOUNT

by

Mary Stevens

Assistant Editor/Assistant Information Officer, NSCA

From Middlesbrough to Magdeburg, Woodspring to Warsaw, well over 400 delegates from all over the United Kingdom, and all over the world, convened in Brighton to give this year's national NSCA Conference a truly international flavour. The simultaneous visit of the IUAPPA Executive and speakers from Eastern and Western Europe served to emphasise that pollution is a global, transboundary problem. Issues closer to home were also discussed as part of a wide ranging programme which contained topics of interest to everyone.

Acid Rain

Sir John Mason, in his second year as NSCA President, used his opening address to give a comprehensive review of the findings of The Royal Society Study on Acid Rain (see this issue of *Clean Air*). His presentation of the current situation in Britain set the scene for the following day's discussion on the next steps to be taken in tackling the acid rain problem on an international basis.

The transboundary nature of acid deposition was examined by Dr. Trond Iversen of the European Monitoring and Evaluation Programme (EMEP) in Norway. He emphasised that EMEP research shows that overall only 20-30 per cent of sulphur and 10-15 per cent of nitrogen emissions are deposited within a country's own borders. The rest is transported elsewhere — up to 1000 km — on prevailing winds; thus demonstrating that the problem of acid rain within a particular country cannot be solved without negotiating emission reductions with other European countries.

The debate then moved on to the problems faced by individual nations in reducing acid emissions. Dr. Romauld Sulima presented a paper on behalf of Polish Environment Minister Prof. Maciej Nowicki. He described the appalling environmental problems of Eastern Europe, where 50-80 per cent of forests are threatened and life expectancy is decreasing because of pollution — mainly from the low grade brown coal that is used to fuel industry. In the newly democratised countries where resources are stretched, Western aid is desperately needed to support the environmental control programmes being implemented there, and that will ultimately benefit the whole of Europe.

Dr. Klaus Grefen (VDI Reinhaltung der Luft, Western Germany) and Dr. B. Thriene (District Hygiene Inspector, Magdeburg, Eastern Germany) analysed the

environmental problems of the former German Democratic Republic — the area with the highest air pollution levels in Europe — and set out the new programme of emission control and monitoring, which, it is hoped, will rectify the ecological imbalance in Central Europe. Meanwhile, Dr. Tom Crossett of National Power looked at control options from a UK standpoint, concentrating on the electricity industry.

Prof. Louis Clarenburg of the Netherlands, in opening the subsequent discussion, pointed to the need for sustainable development and questioned the political determination of the nations concerned to adopt sustainable policies. He quoted Steve Hart, President of IUAPPA — “You cannot have a good economy without a good environment”.

Energy and the Environment

It is only relatively recently that global environmental problems have been taken seriously by governments. Energy use is central to the problem of global warming and the theme of this discussion was global energy strategy. Richard Sandbrook of the International Institute of Environment and Development reviewed the position of the developing nations — he stated that a strategy that is good for global warming is also beneficial for developing nations and ultimately for the industrialised countries too. He pointed to the anomalies in statistics on relative contributions to global warming and therefore the anomalies in trying to take action under a global convention, and that individual goals for reducing emissions on a national basis would be more realistic than international targets. Michael Grubb (Royal Institute of International Affairs) assessed the position of the industrialised nations, seeing global warming as a major issue affecting all areas of policy making including transport, industrial structure and international trade. He was pessimistic about the ability of the industrialised nations to agree on a strategy to solve a problem that affects all areas of economic life.

Assessing the Environment

In assessing the quality of our environment and the measures to be taken to protect it, economic and qualitative factors must be taken into account. John Bowers (University of Leeds) looked at the economic value that is placed on the environment, taking issue with the controversial Pearce report (*Blueprint for a Green Economy*) which argues that environmental problems arise as environmental impact is not reflected in the price of goods, and that pollution taxes are the answer. He refuted the argument stating that much environmental damage was caused before the market realised and points to the general unwillingness of the polluted (the consumer) and the polluter to pay for damage that is not immediately perceived. Mr. Bowers saw the problem as one of equity — pollution taxes will hit those who can least afford to pay, and stated that consumption must be sacrificed for investment — and it is the richer nations who should pay. The problem that emerged was that of the actual value that we place on our environment, and once that is attained, how to go about achieving it.

The risk to human and general health has to be assessed when looking at the potential impact of any known environmental hazard. Dr. David Ball (University of East Anglia) pointed out that true risk and the public perception of risk are often divergent. He set out the criteria used when assessing those risks and the relative costs involved.

Dr. Duncan Laxen (London Scientific Services) then examined the steps to be taken by local authorities in assessing the environment. In their efforts to be seen to be green many authorities are carrying out environmental audits. He recommended some guidelines to be taken into account in order to obtain useful results.

Noise

With the simultaneous publication of the report of the Government working party on noise, which recognised the need for an overall improvement in all areas of noise control, this year's noise session was a topical one.

Complaints about traffic noise are steadily increasing. Dr. Kit Mitchell (Transport and Road Research Laboratory), examined current research into Quiet Heavy Vehicles. Questions were raised over present criteria for measuring noise from new, quieter lorries. What is heard does not always tally with what is measured. Delegates were then exposed to an equally annoying noise — the sound of a clay pigeon shoot recorded by Graham Colling (S. Staffs DC). Numbers of clay pigeon shoots have increased dramatically in the last few years and, with rising numbers of complaints about the noise and inadequate legal controls, he called for a unified approach to the problem. The Assessment and Control of Noise from New Developments was examined by Steve Carden (Wakefield CC) who advocated a “prevention is better than cure approach” to noise from new developments and stressed the need for cooperation between environmental health and planning departments in implementing this. He pointed out that planning control is preservation of amenity, while nuisance is a poor standard as it deals only with a complainant's material discomfort. Current DOE guidelines on assessing noise impact of developments were discussed in depth and a revision of circular 10/73 and BS 4142 called for.

Toxics and Nuisance

Pesticides

Pesticides are designed to kill or control plants or animals, so it is no surprise that they may have adverse effects on human health and the environment. However they are also essential to the food production industry. Spraying presents particular problems as droplets are distributed over a wide area. Peter Beaumont of the Pesticides Trust pointed out that there is currently very little accurate information on this pernicious problem. Health effects may be short lived and unreported, and it is often difficult to attribute longer term effects to a particular source. They are also persistent in the environment and accumulate in food chains having been detected in many unexpected places — for example in Antarctic penguins. Systematic research into the effects of pesticides and safer methods of application, and reduction in use were called for.

Contaminated Land

The *Environmental Protection Act* contains provisions for local authorities to maintain a compulsory register of land subject to contaminative use. Dr. Malcolm Aickin of Dames and Moore examined the implications of this, taking into account the difficulties of identifying contamination and the extortionate cost of remedying it. The conclu-

sions that he drew were that we may well have to live with those sites already contaminated, unless they pose a real threat, as we simply cannot afford to clean them up. Further contamination could be prevented if it is understood that integrated pollution control and BATNEEC can be applied to land contamination and deter potential polluters.

Diesel Emissions

Diesel emissions are now the largest source of smoke in urban air and have been given a high profile by NSCA during the past year. Following on from last year's conference discussion of diesel emission controls, Dr. Malcolm Fox of Leicester Polytechnic looked at the way forward for the 1990s. The problems of meeting tougher diesel emission standards were highlighted, with the suggestion that methanol should be seriously considered as an alternative fuel. He stated that, in an international market there is no need for EEC legislation to lag behind US standards. The importance of enforcement procedures to ensure a real reduction in emission levels was emphasised, and he felt that suitably resourced environmental health departments would be the appropriate bodies to enforce new standards. With two local authorities currently running pilot diesel spotting schemes, the effectiveness of local authorities at controlling the problem within the framework of current legislation is presently being assessed.

Large Cooling Towers

In October 1989 Selby District Council were alerted by residents in Drax village who found their cars covered in a heavy brown silt, which reappeared as fast as it was cleaned up — this lasted for eight days. The silt was raw sewage from contaminated water used in Drax power stations cooling tower. Studies by Environmental Health Officer, Nevil Parkinson, discovered *Legionella* and *E. Coli* bacteria being emitted from cooling towers, and on the failure of HMIP to take action he served a nuisance notice on the station — alleging that National Power failed to properly control emissions. Although there have been no reported cases of *Legionella* being contracted from this source US research has shown that *Legionella* can travel 3 km.

In reply to the allegations of public health risk Mr. D. Penfold of National Power admitted that mistakes were made, but emphasised that measures have been taken to eliminate any problems and that National Power believe that there is no risk to public health from cooling towers.

New Powers for Local Authorities

The *Environmental Protection Act* contains wide ranging new powers for local authorities in environmental control. While tougher legislation is to be welcomed, there is concern at the ability of environmental health departments, whose resources are already stretched, to meet these new responsibilities. Dr. Martin Bigg of HMIP Local Authority Unit looked at integrated pollution control and air pollution control and stressed that if the new legislation is to be workable there must be consistent enforcement by local authorities. The local authority viewpoint was put by Steve Bassam (AMA). He requested that the Government review the effect that the multiplicity of

new legislation would have on local authorities and that resource and training needs have to be taken into account if standards are to be enforceable. There was a consensus on this point from the floor. The funding of enforcement was questioned, but Kay Hunt of the Department of the Environment stressed that registration fees were intended to cover administrative costs, and that the situation would be monitored and reviewed if necessary.

Conference Proceedings

All papers presented during the conference are currently being finalised for publication and will be sent to delegates. To others the cost of individual papers will be £2.50, with the full proceedings at £18.00.

ACID RAIN — CAUSE AND CONSEQUENCE

By

Sir John Mason CB, DSc, FRS

This paper first appeared in March 1990 in "Weather", published by the Royal Meteorological Society. It covers many of the issues discussed by Sir John in his Presidential Address to the Annual Conference of the NSCA.

"Acid Rain" is a short-hand term that covers a set of highly complex and controversial environmental problems. It is a subject in which emotive and political judgements tend to obscure the underlying scientific issues which are fairly easily stated but poorly understood. This review deals solely with the scientific problems, attempts to establish the facts, describes the present state of knowledge and understanding and discusses what research is needed to provide a firm basis for remedial action.

Although the term *acid rain* is commonly used to describe all acid deposition from the atmosphere that may cause damage to trees, vegetation, fisheries, buildings, etc., in fact rain (and snow) brings down only about one-third of the total acid over the UK, two-thirds being deposited in the dry state as gases and small particles. But wet or dry, there is little doubt that acid deposition from the atmosphere poses an ecological threat, especially to aquatic life in streams and lakes on hard rocks and thin soils in southern Scandinavia and in some parts of Scotland and North America. It may also contribute to the serious tree damage reported from Germany and other continental countries, but to what extent it is responsible is by no means clear. In neither case are we likely to resolve the conflicting evidence and opinions and find convincing answers and effective solutions unless we approach the problems in a rational, scientific manner.

The Problem and the Programme

The problem becomes apparent when the damage exceeds a certain level generally accepted as normal and then spreads or intensifies rapidly as the natural control mechanisms fail to cope. It is then necessary to determine, by careful observation and

measurement, the nature, extent and intensity of the damage, the rates of change and whether these are gradual, episodic or step-changes and to compare these with past records if they exist. The next step is to correlate the damage symptoms with internal or external events judged to be likely causes or contributors before invoking more imaginative or fashionable hypotheses.

In most complex ecosystems there is unlikely to be a single well defined cause but rather a combination of several contributory factors, some acting synergistically, others in opposition, so that it becomes necessary to identify and study the controlling processes and mechanisms in what is usually a complex, interactive, multifactorial system. This will often involve a combination of observational and experimental investigations in the field, laboratory and theoretical studies of basic processes, and simulation of the total system or parts thereof by means of mathematical models. Whatever the approach, progress will depend largely on ascertaining the facts from good, reliable observations and measurements.

It is in this spirit that the Royal Society, the Norwegian Academy of Science and Letters and the Royal Swedish Academy of Science, with funds provided equally by the British Central Electricity Generating Board and the British National Coal Board, established in 1984 a major research programme lasting for five years, to study many aspects of the acidification of surface waters in the three countries. This involves more than 30 research groups from a wide variety of disciplines and institutions working in a

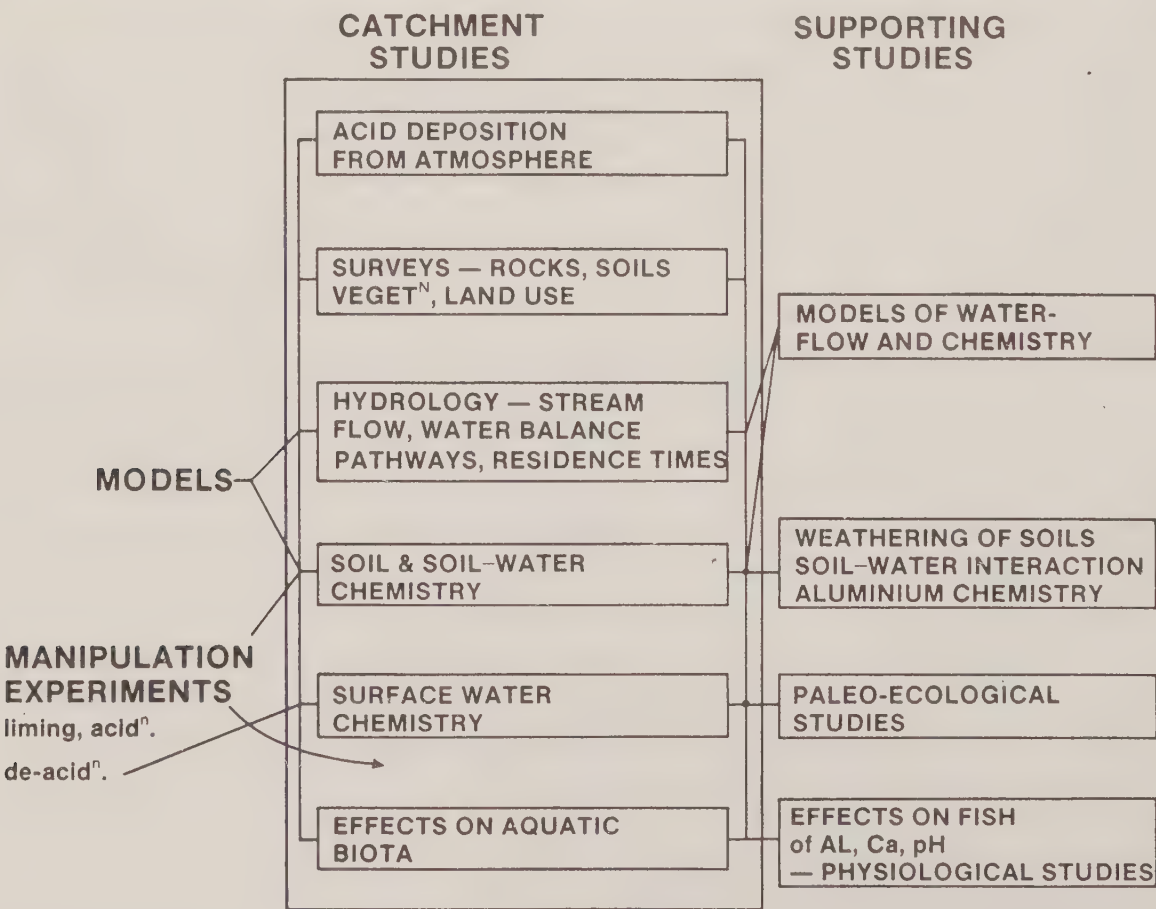


Fig. 1 The scope and organisation of the integrated research programme of the Royal Society and the Scandinavian Academies

closely integrated and coordinated overall programme, the scope of which is illustrated in Figure 1. A complete coverage of the relevant scientific problems includes studies of the transport and chemical transformations of emitted pollutants in the atmosphere; the wet and dry deposition of the resulting acids; the acidity and chemical composition of the rain and snow; modification of the chemistry of the rainwater as it percolates through and interacts with the soil and rocks; and the toxic effects of the modified water chemistry on aquatic biota in streams and lakes.

The Atmospheric Chemistry of Acid Depositions

Understanding the problem of acid deposition requires knowledge of the distribution in space and time of the major acidifying pollutants, SO₂, NO_x and HCl; their chemical transformation in the atmosphere; and their removal by deposition on the Earth's surface, either directly in gaseous or particulate form (dry deposition), or after incorporation into cloud and raindrops (wet deposition). The chemical reactions involved in both the gaseous and liquid phases are complex and incompletely understood but are the subject of much active research involving the measurement of the concentrations and conversion rates of chemical species in the atmosphere, laboratory measurements of key reaction rates, and the use of complex models to simulate the many simultaneous, interactive, chemical reactions.

Emissions

The total annual emissions of SO₂ and NO_x in the UK (expressed in millions of tonnes of S or N), together with figures for Europe, are shown in Table 1.

Table 1. Annual emissions of S and N (Mt/yr) for United Kingdom and Europe

Pollutant	1900	1950	1960	1970	1980	1984	1987
United Kingdom SO ₂	1.4	2.3	2.8	3.0	2.33	1.77	1.93
NO _x	0.21	0.30	0.41	0.50	0.54	0.63	0.74
Europe (excluding USSR)							
SO ₂	—	10.0	—	18.4	20.0	—	—

The United Kingdom contributes <2 per cent to the total input of sulphur into the global atmosphere and <10 per cent of the man-made sulphur produced in western Europe. The UK emissions of SO₂, 60 per cent of which come from power stations and about 30 per cent from industrial plants such as refineries, have fallen by 35 per cent since 1974, but the emissions of NO_x, about 45 per cent of which come from power stations and 30 per cent from motor vehicles, continue to rise. The total deposition of sulphur on the UK in 1980 was 0.7 million tons, about 30 per cent of the emissions, two thirds being dry deposition and one third in precipitation. About 80 per cent of this total deposition was estimated to come from UK sources. The rain-bearing westerly winds ensure that the UK emissions make a significant, but not predominant, contribution to total acid deposition in Sweden and Norway, the contributions being about 5 per cent and 10 per cent respectively, but uncertain by a factor of two.

Chemical Transformations

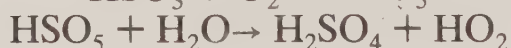
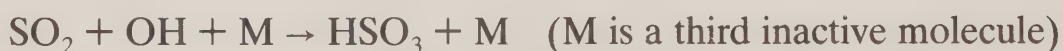
Once emitted into the atmosphere, the pollutants are carried and dispersed by atmospheric motions, the plume from a point source, such as a power station, spreading out into an expanding cone which meanders with fluctuations in the wind. The plume is largely confined to within the atmospheric boundary layer, in the lowest 1-2 km, unless it is carried up into cloud systems. A good deal of the acid deposition reaches the ground in dry (gaseous or particulate) form close to the source but the rest may travel for hundreds of kilometres during which time the gases SO_2 and NO_x are oxidised and converted into lowly volatile products such as sulphuric and nitric acid, either in gas phase reactions or, more effectively, by becoming captured by cloud and raindrops (where the chemical transformations proceed much more rapidly in the liquid phase) and are eventually brought to the ground in rain or snow.

Although acid production proceeds much more rapidly in the liquid phase, clouds and rain are present only a small fraction of the time, so gaseous transformations and deposition are important and account for about two-thirds of the total acid deposition in the UK and about one-third in Norway.

The rates of conversions of SO_2 and NO_x to H_2SO_4 and HNO_3 are determined by measurements from the Hercules flying laboratory of the UK Meteorological Office. This flying laboratory can locate and follow a chemically marked plume from a particular power station; sample the air inside and outside the plume as it crosses the North Sea; analyse it for all the relevant chemical species (for example, SO_2 , NO , NO_2 , oxidising agents such as O_3 , H_2O_2 , hydrocarbons, and aerosols); and collect cloud and rain-water and analyse these for pH, all main ionic species, H_2O_2 and other chemicals. In order to explain the observed conversion rates of SO_2 and NO into acids it is necessary to invoke photochemical reactions involving highly reactive oxidising agents such as O_3 and O^* leading to the formation of the important radical OH which is unreactive to oxygen and therefore relatively stable. Some of the more important chemical reactions may be summarised as follows:

Gaseous reactions in a dry atmosphere

● Sulphuric acid



with HO^* resulting from



The aircraft measurements indicate a conversion rate of about 16 per cent per day in summer, when solar ultra-violet radiation permits ready photolysis of ozone, but this is reduced to about 3 per cent per day in winter.

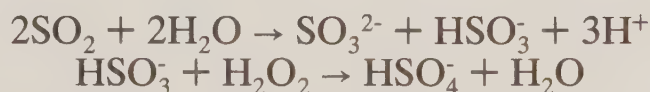
● Nitric Acid



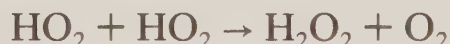
The conversion rate is about 20 per cent per hour in summer and about 3 per cent per hour in winter, so conversion would be complete in a 24-hour traverse of the plume across the North Sea in summer.

Liquid phase reactions in clouds and rain

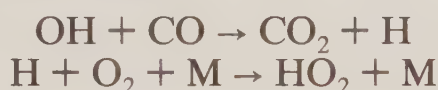
● Sulphuric acid



with H_2O_2 resulting from

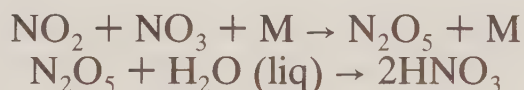


and HO_2 from gaseous reactions such as:



The conversion rates are very fast, almost 100 per cent per hour in summer and 20 per cent per hour in winter in the presence of sufficient concentrations of the oxidants O_3 , OH , HO_2 , H_2O_2 and hydrocarbons which may be the limiting factor.

● Nitric acid



This reaction is believed to be rapid but conversion rates have not been established.

Both the aircraft measurements and the photochemical models indicate that the rates of production of acids from the precursor gases are often limited by the availability of oxidising agents, hydrocarbons and solar ultra-violet radiation.

Acidity of Precipitation

In order to assess the effects of changes in the emissions of SO_2 , NO_x and hydrocarbons on the acidity of precipitation, it is necessary to have long term, reliable, accurate and representative measurements of pH, alkalinity, and concentrations of the main ionic species SO_4^{2-} , NO_3^- , HCO_3^- , etc., so that one may study their variations in space and with time. Unfortunately, rather few series of measurements satisfy these criteria. Accurate measurement of the pH of poorly buffered waters in the field is particularly difficult. In addition to analysis errors, changes may occur during collection, storage and transport, resulting in contamination, evaporation and biological activity of the sample. In our programme we have paid great attention to the improvement of analytical techniques and to their standardisation, intercomparison and intercalibration.

The pH of uncontaminated rainwater in equilibrium with atmosphere carbon dioxide is 5.6. Rain and snow almost everywhere, even in places as remote as Hawaii, the southern Indian Ocean and the polar regions, are more acidic than this, with average pH values of 5.0 or lower. This testifies to the ubiquity of acidic pollutants, the oceans being a major source of sulphur compounds resulting from biological activity and sea spray.

In 1978/80 the annual average pH of rain falling over the UK was almost everywhere between 4.5 and 4.2. The rain was more acidic on the eastern side of the country downwind of the main industrial conurbations, where the pH values are very similar to those encountered in southern Scandinavia.

Unfortunately, there are few reliable, long term records with which to assess recent trends in the acidity of precipitation. Perhaps the best record, maintained by the Freshwater Biological Association in Cumbria, shows that the annual mean pH remained sensibly constant at 4.4 between 1955 and 1975, during which period the total sulphate deposition also remained roughly constant. This is consistent with the fact that the UK emissions of SO_2 and NO_x combined, increased only slightly over this period and that 80 per cent of the total sulphur deposition in the UK comes from local sources. There is now some evidence, notably from measurements made by the Freshwater Fisheries Laboratory at Pitlochry, that the acidity of rainfall decreased (pH increased by about 0.2 unit) between 1979 and 1984, in conformity with the 34 per cent reduction in UK SO_2 emissions over that period. The sulphate concentration of rainwater collected in the Scottish Loch Ard catchment has halved since 1982. Moreover, between 1973 and 1986, the pH increased from 4.2 to 4.7, during which time UK emissions of SO_2 fell by 36 per cent.

In Europe there is also a dearth of reliable long term measurements, and some of the reported rather sharp increases in acidity of precipitation appear to have coincided with changes in measuring techniques. On balance, the evidence indicates that the acidity increased gradually from 1955 to 1970, during which time European emissions of SO_2 doubled, but there are indications of a slight reduction in the acidity and sulphate content of rainwater since 1980, concurrent with reduced emissions.

There is some evidence of a linear correlation between the sulphate content of rainwater and emissions of SO_2 based on average annual values, but the implications of this are complicated by the fact that, in many parts of the UK and southern Scandinavia, a large fraction of the total annual acidic deposition occurs on only a few days of heavy rainfall. In order to detect these high deposition episodes, which have a major ecological impact, frequent or continuous monitoring of the rainfall and its chemistry is necessary.

Moreover, the annual averages hide large seasonal variations in the acidic and sulphate content of UK rainfall, with the highest values occurring in summer when the emissions are least. This is probably a consequence of the fact that the conversion of SO_2 and NO_x to acids is limited by the availability of oxidants such as O_3 , OH , H_2O_2 , which are produced by photolysis more effectively in the summer time.

The Acidification of Streams and Lakes

Measurements in many lakes in southern Scandinavia suggest that the pH has decreased by between 0.5 and 1.0 unit over recent decades. However, there is some doubt about the reliability of the measurements and the comparability of past and recent data. A reduction of one whole pH unit is unlikely to be due solely to increases in European emissions of SO_2 and NO_x which only doubled between 1950 and 1970 and have increased only slightly since then. Part of the decrease in pH may have resulted from

additional acidification processes at work in the catchment, or from the acid neutralising mechanisms in the soil not being able to keep pace with the acidic deposition (see next section). By contrast, biologically inactive lakes in Cumbria subject to acidic rainfall, with hard bedrocks and thin soils, very similar to those prevailing in southern Scandinavia, have shown no significant change in acidification over the last 50 years, during which period UK emissions of SO_2 doubled between 1930 and 1970 and have fallen by 35 per cent since then. In biologically active lakes, major changes of pH are caused by respiration, by photosynthesis and by decomposition of vegetation, and these often show strong diurnal and seasonal variations.

A chemical survey of some hundreds of lakes in southern Norway in the early 1970s revealed that 40 per cent of them had pH values of <5.5 and 16 per cent had pH values of <5.0 . These, and some additional lakes, about 1000 in all, have recently been re-surveyed, using the same techniques, to determine whether there have been any significant changes in the intervening 12 years during which there have been marked reductions in emissions of SO_2 , especially from the UK and Sweden. The results for lakes in areas of high acid deposition show a marked reduction in sulphate concentrations but a compensating increase in nitrates, so that, on average, the acidity (pH) has hardly changed. Lake Oxsjön in Sweden, the sulphate concentration of which trebled between 1967 and 1977 while pH fell from 6.8 to 4.5, has shown signs of recovery since 1977, with the pH increasing to 4.9 and the sulphate concentration falling by one-third.

Evidence for the gradual acidification of lakes over longer periods comes from the analysis of acid sensitive species of diatoms from radioactively-dated lake sediments. The layers of sediment, laid down over several hundred years, are dated using radioactive lead isotopes and the diatoms found in the layers are correlated within similar populations found in the uppermost layers of lakes of known pH. It is thus possible to reconstruct a pH-age profile of the sediments. By this method it has been found that some lakes in Scotland which are situated on hard granite bedrock and thin soil and in areas of high deposition, have tended to become acid in recent decades. By contrast, little change in diatom populations has occurred in non-sensitive lakes in areas of high acid deposition, nor in sensitive lakes in areas of low deposition. Figure 2 shows that the pH of Round Loch remained sensibly constant at 5.5 between 1600 and 1850 but thereafter steadily declined, with fluctuations, to 4.8 in 1973, the decline being particularly rapid since 1900, but this cannot be attributed to afforestation or changes of land use. A slight recovery to pH 4.9 is discernible between 1973 and 1980, associated perhaps with reduced emissions. Similar evidence for a slight recovery has been found in some other Scottish lochs in areas of high acid deposition.

A similar study on lakes near the south-western coast of Sweden, all afforested with hard bedrock and thin soil, also indicated a fall in pH from 6.5 to 4.5 since 1950. Diatom records from lakes in southern Norway also indicate a decrease in pH over recent decades, but a lake on the west coast with pH ~ 5 showed no significant change over 200 years.

The decreases in pH since the industrial revolution are likely to be due mainly to increased acidic deposition from the atmosphere, but more extensive measurements involving a wider variety of acid sensitive species are required to establish the historical

trends and help resolve the apparent differences between the results for different locations.

Apart from the effects of man-made depositions, there appears to be a natural tendency for lakes to become more acidic with time due to the natural acid producing mechanisms in the soil (see next section) and a gradual decline of its neutralising capacity. These natural acidification processes are normally slow but may be accelerated by changes in land use. There is also evidence to suggest that the planting of coniferous forest accelerates acidification in areas of high deposition, due to the scavenging of acid aerosols and mist droplets by the forest canopy.

The general inference from these studies is that a large reduction in acidic emissions and depositions is likely to lead to a fairly rapid response in lake chemistry in some regions but, in others, particularly those where there are large accumulations of sulphate in the soil, recovery may be much slower.

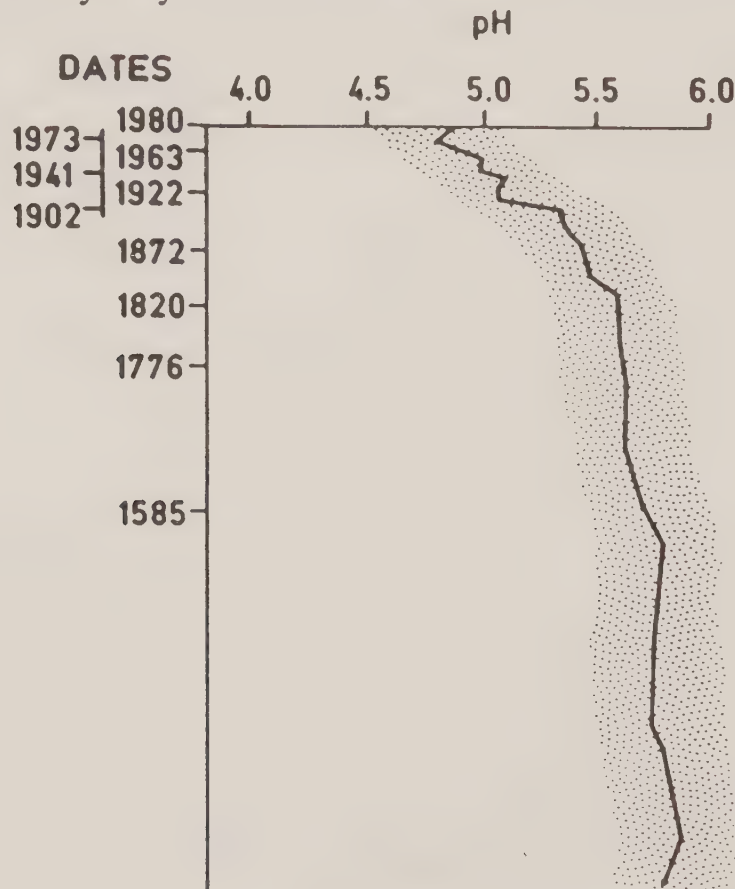


Fig. 2 The history of acidification of Round Loch of Glenhead (Galloway, Scotland) as deduced from diatom records (Courtesy of Dr. R.W. Battarbee)

The Importance of Hydrogeology and Soil Chemistry

There is undoubtedly a correlation between rainfall acidity and the occurrence of acid streams and lakes in susceptible areas. However, little of the water feeding streams and lakes arrives directly from the atmosphere; most does so only after flowing over the land surface or through soil. The details of the flow pathways and of the soil water interactions are not well known. Hydrological conditions and water flow pathways through

the soil and rock determine the contact time of the acidified water with neutralising substances and thus the ultimate degree of water and soil acidification.

When the acidified rainwater reaches the ground some seeps through the soil but some, especially during continuous heavy rain, runs over the surface or through macropores and may enter the nearest stream with its chemical composition little changed. If, however, the rainwater penetrates the soil, its chemistry may be profoundly modified as the result of complex reactions with the underlying rocks, soil and vegetation involving many processes such as dissolution and weathering of minerals, cation exchange, accumulation and release of contaminants including humic and other organic acids.

If the rain or melt water of low pH passes through sandy soils poor in base minerals (e.g. Ca/Mg carbonates and bicarbonates) or passes over hard granitic rocks, then the rain/melt water will only be partially neutralised by cation exchange or weathering. The H^+ ions in the percolate will tend to be associated with SO_4^{2-} ions. In most catchments any NO_3^- ions which are present in the rain are largely taken up by the roots of growing plants and trees, thus immobilising the associated H^+ ions. (This may change if the increasing trend in NO_x emissions continues.) The acidified water therefore passes through the soil with only a moderate pH change, and the soil itself undergoes little acidification.

In base-rich soils, H^+ ions in the acid water are either neutralised by bicarbonate ions during the dissolution of limestone or removed by exchange with cations such as Ca^{2+} , Mg^{2+} , K^+ , Na^+ , Al^{3+} on the surfaces of mineral particles, or with cations on organic macromolecules in humus. H^+ ions may also be consumed in the soil by the reduction of nitrates and sulphates.

Chemical weathering of primary and secondary minerals are the ultimate means by which inputs of acids are counteracted. Chemical weathering transfers basic cations from primary minerals to the pool of exchangeable cations. A fraction of these are retained on the surfaces of soil particles and the remainder are lost in the run-off or percolate. H^+ ions from the acidic inputs are exchanged for the basic cations on the surfaces of the soil so that the acidity of the percolate decreases and that of the soil tends to increase. If the release of base cations by weathering keeps pace with the rate of increase of acid input, no soil acidification occurs. However, if the rates of chemical weathering are not increased sufficiently, soil acidification and subsequently water acidification results. Soil acidification partly caused by acid deposition seems to have occurred both in central Europe and in Scandinavia.

However, besides the deposition of acid substances from the atmosphere, several natural processes produce H^+ ions in the soil and reduce the pH of the percolating water. These include the production of carbonic acid by CO_2 , the hydrolysis of minerals, the decomposition and nitrification of ammonium produced by bacterial decomposition of vegetation and by fertilisers, the oxidation of sulphur in dry soil, the action of organic acids from decaying humus, and the release of H^+ ions from the roots of plants and trees to compensate for the take up of Mg^{2+} and Ca^{2+} ions.

The acidity/alkalinity of the percolate is the net result of all these processes which act at different rates depending, in many cases, on the pH. In general, base-rich, weath-

erable soils tend to reduce the acidity of the percolate, whilst growing plants and trees, aided by fertilisers, tend to acidify both the soil and soil water. The deposition of acidifying components is also in general larger in a coniferous forest than in an unforested area. The rate of water acidification and the time lags involved probably depend very much on the amount of sulphate accumulated in the soil and the rate at which the SO_4^{2-} ions are released to accompany the H^+ ions in the percolate. After a long dry spell followed by heavy rain, or during snow melt, there is often a heavy transient release of mobile anions including NO_3^- which cannot all be taken up by plants and so is available for mobilising the H^+ ions, thereby increasing the acidity of the soil water.

In our programme we have investigated the above mentioned processes, chemical biological, and hydrogeological, that determine the quality of the surface waters and therefore the populations of fish and the organisms that provide their food. In each experimental catchment we have conducted detailed surveys of the geology, soils and vegetation and the mapping of the hydrogeological pathways of the water over and through the ground on its way to the streams and lakes. Of key importance is the modification of the chemistry of the water as it percolates through the soil by a variety of acidifying and neutralising processes. This has been studied by extraction and detailed chemical analysis of the percolate from different levels in the soil profile and relating these changes to the physical and chemical properties of the soils, measured weathering rates of the minerals, the rates of water flow (residence times) and the measured input/output budgets of the whole system. By making parallel studies in highly acidified, "clean" and intermediate catchments, it should be possible to deduce how the contributions and balance of the various processes and agencies are affected by changes in acid deposition.

Considerable effort has also been devoted to the development of hydrochemical models to help identify the key processes, design the field experiments and interpret the results.

Effects of Acidity and Aluminium Toxicity on Fishes

A decline in fisheries, or loss of certain species since the 1930s has been reported for many lakes in south Norway, south Sweden, parts of UK, Ontario and north-east USA. In view of the (not entirely convincing) evidence that the pH of some lakes has declined by as much as 1 whole unit and that low pH (<4.5) is known to be lethal to fish, especially in early life stages, it is reasonable to attribute decline in fish populations to an increase in acidity of surface waters. Unfortunately, well documented, long term records of fishery status and of water quality exist for only a relatively few lakes in Scandinavia and north-east America. For a sample of lakes in Europe and North America, over half of those with $\text{pH} < 5$ were found to be fishless compared with about 1 in 7 of those with $\text{pH} > 5$. This is illustrated in Figure 3 which also shows the importance of Ca in the water, higher concentrations of which tend to compensate for lower pH (higher acidity). An extensive survey of fishery status and water quality for some 700 lakes in south Norway failed to establish a direct relationship between fishery status and sulphate concentration because the calcium concentration and pH of the lakes, which are correlated with their altitude and distance from the coast, are dominant factors. More recently the toxic effects of aluminium leached from the soil and lake sediments have

become firmly established. The toxicity of aluminium is a function of pH and is greatly moderated by the presence of calcium in solution.

In the pH range below 4.5 acidity *per se* may be a direct cause of mortality in fish depending on the species (salmon and trout are especially vulnerable), the age, size and genetic origin of the fish and the degree of acclimatisation. Acidity may also affect growth, fertility, egg mortality and recruitment of fry to the population.

Attempts to establish clear-cut relationships between water acidity and fishery status have been hampered by conflicting evidence between field observations, which are usually concerned with long term and fluctuating acid exposures, and laboratory studies which almost always involve short term, constant exposures. It is important to investigate the response to both types of exposure, long term and episodic, since it is not clear which is the more important in the depletion of fish stocks. However, there is increasing evidence that large kills are produced by short episodes of high acidity, lasting only a few hours and associated with snow melt, or rain after a long dry spell. It appears that these occasional or seasonal pulses of acidity, often accompanied by high concentrations of aluminium are more lethal than sustained exposure to which the fish may adjust more easily.

The toxic effects of aluminium on fish are complex. They are very sensitive to pH and are strongly moderated by the presence of calcium or organic acids in the water.

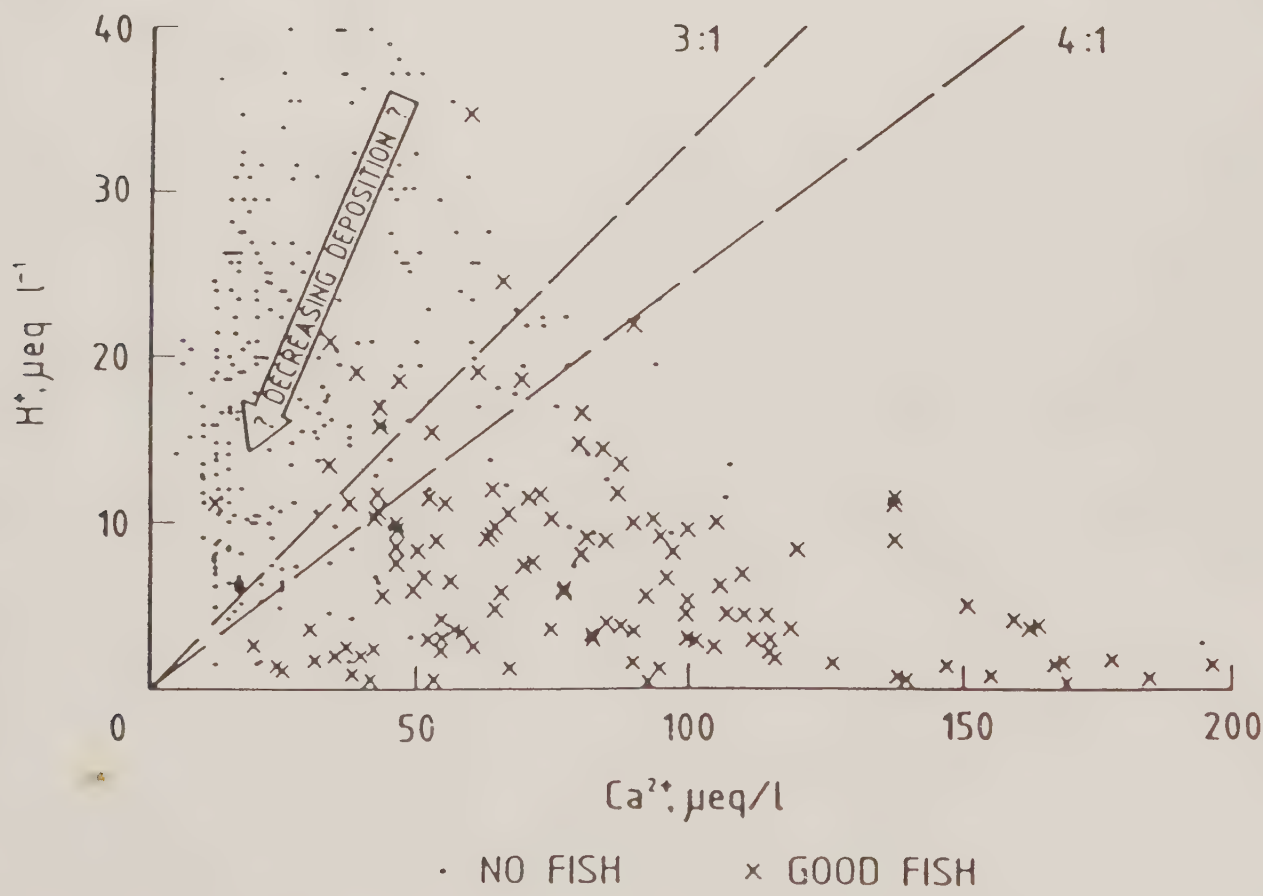


Fig. 3 The fishery status of a large number of Norwegian lakes in relation to their acidity (H^+ ion concentration) and the calcium content.

Only the inorganic monomeric aluminium, such as Al hydroxides and fluorides, appears toxic when its concentration exceeds 100 µg/l, which is a typical value for Scandinavian and North American rivers and lakes at $\text{pH} < 5$. In the presence of organic acids derived from humus in the soil, the aluminium tends to form organic complexes, which are not toxic to fish.

The apparently opposing effects of Al and Ca are far from being understood. Prolonged exposure to Al at $\text{pH} \approx 5$ causes severe damage to the gills and causes clogging by excess mucus. Freshwater fish continually lose salts in the large quantities of urine discharged to counteract the osmotic inflow of water. The salt loss is normally made good by ion exchange across the gill surfaces, the magnitude and direction of the flux being determined by the distribution of electric charge across the gill membrane. In acid water of very low Ca content, this charge may be reversed so that the fish blood loses salt and becomes more acid. The adsorption of Al, particularly in the form of Al^{3+} and Al hydroxide ions, appears to damage the gills and further impair the ion-exchange process. However, if Ca is present, its ions are apparently preferentially adsorbed on the gill surfaces, where they block the absorption of Al ions and so reduce their impact.

The detailed mechanisms involved in the control, regulation and impairment of ion exchange across the gill membranes will have to be further elucidated before the relative toxicity of the various aluminium species and their moderation by calcium and organic complexation can be assessed. Such studies form an important part of our programme.

Concluding Remarks

I have attempted in this paper to demonstrate that acid rain is a complex problem spanning a wide range of disciplines and that there are considerable gaps in our present understanding of all the contributory mechanisms and their interactions. I believe that our comprehensive, strongly coordinated and focused research programme will have done much to increase our knowledge of recent changes in the chemistry and biology of surface waters, elucidate the underlying mechanisms, establish more accurately the contribution made by man-made emissions relative to natural acidification processes, and provide a firm scientific basis for effective remedial action.

The full results were presented and discussed in an international conference held at the Royal Society from 19-23 March 1990.

NSCA NEWS AND VIEWS

NSCA ANNUAL STRAW AND STUBBLE BURNING SURVEY

INTRODUCTION

After many years of campaigning by NSCA, a ban on straw and stubble burning has finally been secured. Section 152, Part VIII of the *Environmental Protection Act 1990* gives powers to ban the burning of crop residues on agricultural land. While this is to be welcomed, concern has been expressed at the potentially wide ranging exemptions contained within the Act. NSCA continues to monitor the situation. 1990 was a year of exceptional drought and burning patterns were affected by weather conditions. In many areas burning was either curtailed or concentrated, but the number of fire brigade call outs suggest that where burning did take place there were serious problems. Although our survey results (see box) suggest that the attitudes of many farmers are changing and that many are using alternative methods of disposal in anticipation of the ban, there are still particular problems in some areas, and the powers of exemption currently contained in legislation suggest that some of these problems may well persist.

EXISTING CONTROLS

Byelaws

Most local authorities with large areas of arable crops have adopted model byelaws which control the burning of straw and stubble and other combine harvested crops. Under these byelaws farmers must notify authorities that they are burning and provide adequate firebreaks, supervision and firefighting equipment and refrain from burning at weekends and bank holidays or in unsuitable weather conditions. The maximum fine for contravention of these is £2000. Enforcement of the byelaws is seen as difficult by environmental health officers as they usually have inadequate staff for surveillance and can only respond to complaints; consequently burns are frequently over before an officer arrives.

Even where byelaws are complied with, very often problems with nuisance and general environmental damage remain, as this years' survey results show.

NFU Code

The National Farmers' Union (NFU) published a Straw and Stubble Burning Code in 1986 designed to keep farmers within the law. In recognition of the extent of the problems caused by burning, the NFU consulted NSCA and other interested bodies on a revision of the Code in 1990. The emphasis of the code is, understandably, on safety. However, the new 1990 version is more specific in its recommendations, emphasising the importance of avoiding nuisance to the general public by inconsiderate burning, reducing the time limit for ash incorporation from 36 hours to 24 hours, and increasing

safety margins by extending firebreak requirements — now 50 metres from any building (was 25m), and 100 metres from main roads or railway tracks. It was hoped that the code would alleviate any problems in the remaining burning seasons — however the consistently high numbers of fire brigade call outs and public complaints in some areas indicate that this is not necessarily the case.

SURVEY RESULTS

Straw and Stubble Burning

The results of the 1990 survey show that problems were not as widespread as in previous years. The number of complaints, while considerably less than in 1989, is still greater than in previous years, and the number of fire brigade call outs remains at a consistently high level. Local weather conditions play an important role; during calm periods smoke can envelop large areas — for example the City of Peterborough experienced such dense smoke that the streetlights came on at midday. Once again, the figures obtained do not reflect the true extent of complaints as many authorities have insufficient staff for surveillance, complaints are made to other bodies — the police and fire brigade — and figures for fire brigade call outs are unknown in some areas. Again the inadequacy of current controls has been highlighted.

1990 was an exceptionally dry summer, and the number of fire brigade calls may be a reflection of this — or equally of the attitude of the irresponsible farmers who insist on burning in unsuitable weather conditions. One area reported 12 farmers requesting their own fires to be put out! In general farmers' attitudes were seen to be improved, and many seem to be finding alternatives in anticipation of the ban. Notifications were down — partly due to this, and according to some authorities, partly due to drought conditions. However, in some areas there is apparently a hard core of persistent offenders.

It is therefore important that the question of exemptions from the forthcoming crop residue burning ban is carefully considered, and that potential loopholes are spotted.

Agricultural Burning

In the past many local authorities have been advised that they are unable to prosecute farmers for burning waste in the open as farmland has not been considered "trade or industrial premises" under the *Clean Air Act 1968*. NSCA wrote to Environment Minister David Heathcoat-Amory earlier in 1990 and he confirmed that "if land is being used for commercial agriculture or horticulture it constitutes trade premises for the purposes of section 1 of the *Clean Air Act 1968*." The majority of authorities felt that this clarification of the legislation would assist them in controlling general agricultural burning where it presents a problem. Langbaugh BC have since successfully prosecuted a tyre burning farmer, although Macclesfield BC are credited with a successful prosecution under the *Clean Air Act 1968* in 1981!

CONCLUSION

Our overall impression is that, despite some localised problems, the 1990 burning season was less disastrous than the 1989 burn. However complaints and fire brigade call

outs remain at an unacceptably high level, so we must hope that the downward trend continues during the next two harvests, leading up to the ban in 1993.

Some Statistics from the 1990 Survey

(1989 figures in brackets)

No. of local authorities providing information 156 (167)

Of the 141 (129) LAs which received complaints, the following are the no. of complaints received relating to:

— smoke/smut nuisance	814 (1635)
— reduced visibility on roads	59 (223)
— effects on human health	88 (311)
— threat/damage to wildlife	49 (154)

Fire Brigade involvement

84 (78) fire brigades dealt with
922 (1219) separate incidents

Most of the LAs responding use either the 1984 or 1985 byelaws to control burning.

Infringements reported include:

— insufficient firebreaks	41 (57)
— insufficient fire supervision	23 (42)
— burning in high winds	23 (34)
— burning after sunset/at weekends	15 (26)
— notification of relevant authorities	44 (39)

Enforcement problems include:

— insufficient staff for surveillance	76 (88)
— gaining evidence for prosecution	22 (32)
— locating burn and gaining access	36 (55)

CAN BRITAIN AFFORD TO WASTE DOMESTIC WASTE?

Domestic waste is potentially a useful resource; much of it — perhaps up to a half — could be recovered for recycling, but the economics are often unfavourable. Controlled landfilling with recovery of the methane gas which currently causes justifiable concern is another option. Finally the incineration of waste under properly controlled combustion conditions can both reduce the volume of waste and be a valuable source of energy. However, the NIMBY syndrome dictates that nobody wants a waste disposal facility near their own back yard. Incineration in particular has had a bad press in the past.

In December, NSCA published a discussion paper by Byrom Lees, who is a fuel

technology consultant and member of NSCA's Technical Committee, which outlines the future potential for landfilling and incineration.

Byrom Lees has attended various conferences at which the disposal of municipal waste has been discussed and it is based on the papers given at these conferences, that he reviews the situation in the UK and puts forward suggestions for future developments. He points out that, at present, over 90 per cent of municipal waste is disposed of in landfill sites but it is considered that this method of disposal should no longer be tolerated because:

- (a) the pollution caused by landfill, particularly the emission of methane, is one of the major contributors from the UK to the greenhouse effect;
- (b) the waste is a valuable potential fuel; and
- (c) the rapid decline of the availability of landfill sites.

The discussion paper concludes that municipal waste should be incinerated in large incinerators of designs readily available in Europe and North America which meet the strict standards of the appropriate European Community Directive. The generated heat should be used in power schemes or, preferably, in local combined heat and power (CHP) schemes similar to systems widely adopted in Europe. The initial capital cost of the plant will be high; however these costs should be partially met with assistance from Government or regional subsidies. Alternatively, they could be met by legislating to levy a tax on domestic waste disposed of on landfill sites on the "polluter pays" principle to support the capital costs of incineration plant.

NSCA has published the discussion paper, *Can Britain afford to waste domestic waste?*, as a contribution to the debate surrounding UK waste disposal policy. Further copies are available from NSCA at 136 North Street, Brighton BN1 1RG.

NEW NSCA TEACHING PACK

THE GREENHOUSE EFFECT

The latest NSCA teaching pack covers the complex issue of Global Warming, or the Greenhouse Effect. The pack contains Information, Evidence and Enquiry sheets which form the basis for a class exercise for 14 - 16 year olds. The A4 format is designed to be photocopied for class use. The pack also contains a role play exercise and teachers' notes.

Three other NSCA teaching packs cover the subjects of air pollution, acid rain and noise. All teaching packs cost £3.00 including postage and packing.

NSCA - 136 NORTH STREET - BRIGHTON BN1 1RG

SCOTTISH DIVISION: ENVIRONMENTAL SEMINAR

The Scottish Division held a seminar on 20 November in Edinburgh. Among the subjects covered were environmental assessment, environmental auditing and acid rain.

ACID RAIN

Sir John Mason, NSCA President, summarised the main results and conclusions of the recent Anglo-Scandinavian research programme into acidification of lakes and streams. He explained the mechanisms of acidification in particular the crucial role of soil chemistry. He outlined the various studies which were carried out as elements of this programme on e.g. acid deposition, rock soil, vegetables and land use, hydrology, soil and soil waste chemistry, surface water chemistry and effects on aquatic biota.

Dr. Gerry Best of the Clyde River Purification Board, said that acid deposition was a particular problem in Scotland, despite the fact that most of the acid emissions are to be found elsewhere in the UK, because of the very elevated rainfall in Scotland, particularly in the West. The most acid waters are to be found in south-west Scotland due to high rainfall and low alkalinity in the soils. He said that there is now evidence that the significant tree planting (conifers) which is taking place in Scotland could effect an improvement in river and lake pH due to reduction in emissions, as they are effective filters of pollution. The River Purification Boards are currently working with the Forestry Commission to identify sensitive areas for acid deposition and setting limits on tree planting in these sensitive catchment areas.

Brian Stewart (Scottish Power) looked at gaseous emissions from power stations and the Loch Fleet project. The catchment area around Loch Fleet, which was very acidic, was treated with calcium carbonate. The catchment was split into 13 separate areas. These were progressively treated with liming, either dry, slurry or bog liming. The lime was added at rates of 5-30 tonnes/hectare. Measurements of water chemistry were then made, of particular interest being the pH, calcium and aluminium levels.

The only adverse effect of liming which was observed was some kill of sphagnum moss, since this species is acid loving. However the Loch is now supporting a thriving population of brown trout.

ENVIRONMENTAL ASSESSMENT

Dr. Brian Clark of the Centre for Environmental Management and Planning emphasised that environmental assessment should not only be seen as a means of complying with the requirements of planning legislation, but should be seen as a means of identifying and minimising environmental impacts of a proposal. However, it should be noted that monitoring of the implementation is a very necessary part of the process. Public participation was identified by Doctor Clark as a very necessary part of the EIA process, and he stressed that this should be carried out at an early stage. He said that in terms of the Environmental Assessment Regulations proposals for Schedule 1 developments require assessment, while Schedule 2 developments only require assess-

ment where the impact is liable to be significant. He said that there were real difficulties in determining what constitute "significant impact".

A second speaker, Mr. Matthew Davies of Montagu Evans felt that the biggest criticism which can be made of environmental assessments is their lack of scientific precision. He also felt that sometimes EIAs lacked an adequate assessment of the technical aspects of a proposal, e.g. detailed analysis of air, land or noise pollution liable to be produced by a proposed development. He identified certain key areas which he felt could lead to improvements in the EIA process, and he felt that statements should only be demanded when they are genuinely required. Mr. Davies stressed the need for input from planners, from colleagues (EHOs), statutory consultees, etc., and that objectives should be clearly identified. Planning authorities, he felt should give clear instructions to developers on expectations from the process.

ENVIRONMENTAL AUDIT

Amanda Chisolm, Centre for Environmental Management and Planning, suggested that all companies should have regard to environmental management as part of their company strategy. She explained that environmental management could comprise several components, such as environmental impact assessment, environmental monitoring, environmental auditing and emergency/contingency response. There was also an increasing need and desire for companies to produce "green audits", due to the increased environmental legislation being enacted by the EEC and UK Government; she also suggested that local government should have a policy on the environment to identify what it wants to do, and an environmental strategy, to tell it how to get there. She suggested that an environmental audit was a means of achieving these objectives. Ms Chisolm identified a number of advantages to local authorities in carrying out an environmental audit, such as improved planning process, an improved environment and political benefits (authority is perceived to be "green"). However disadvantages could be political vs. objective activity; information problems; iterative process; rivalry; different government levels.

Mike Philpott of Shanks and McEwan said that his company dispose of 7m tonnes of waste annually and that they regard their environmental audit process as a fundamental feature of their environmental policy. He outlined his company's quality assurance management system, which has the following features: quality assurance team; training in quality assurance; procedures and work instructions; implementation; auditing; assessment; and results.

He also outlined the principles and objectives of his company's environmental policy, as staff education and training; setting high standards of operation; liaison with the local community; "open door" policy; communication with staff and customers; work with conservation groups, and research.

The next meeting of the Scottish Division is on 6 February, with the AGM in the morning and a seminar on transport pollution in the afternoon.

REPORT

AIR QUALITY IN LONDON

by

Dr. Duncan Laxen

LSS, Environmental Consultants

This paper reviews urban air quality in London and discusses some of the lessons learnt from the many years of study by LSS and by its predecessors the Greater London Council. It should be pointed out that there is no longer one authority responsible for the Greater London area, but rather responsibility is divided amongst 33 local authorities. This makes a coordinated approach to air quality difficult if not impossible.

There are two key items of information that are necessary to gain a proper understanding of air quality and thereby to be in a position to tackle any problems. The first is the requirement for information on pollutant concentrations, both at the present time and over a sufficient time in the past to identify trends. The second is for information of the sources of the pollutants. The point will also be made that air quality criteria are necessary in order to assess the measured pollutant concentrations. In this regard attention will be drawn to the air quality guidelines published by the World Health Organisation (WHO) in 1987. This is a particularly valuable document and the guidelines provide the basis for the daily Air Watch service that LSS operates in London to provide information to the public on air quality.

Air quality monitoring in London can be traced back to 1931. The results of monitoring at County Hall in central London from 1931 to 1985 are illustrated in Figure 1. The different lines show results for different measurement methods and slightly different sites. The general pattern was of high annual mean levels (around 300-400 microgrammes per cubic metre) through until the middle of the 1960s and then a steady decline from that date, which has continued to this day. Annual mean levels are now around 20-30 $\mu\text{g}/\text{m}^3$, except alongside roads where levels are two to three times higher. They are now well below the UK air quality standard.

The first emission inventory for London was carried out in 1976 and was repeated again in 1984. These were surveys of sulphur dioxide and nitrogen oxides emissions from sources across the whole of Greater London — over 1500 square kilometres. They provided information on where the sulphur dioxide was coming from, both in terms of type of source and location.

The burning of fuel oil (that is heavy oil) was the main source of sulphur dioxide emissions (Figure 2). There was also a big decline in emissions between 1976 and 1984. This was mainly due to the change to the use of gas as a fuel instead of oil and coal. Also

many of the smaller power stations in London closed down, to be replaced by larger ones outside London to the East along the estuary of the River Thames.

In 1980 the European Community introduced the air quality standard for sulphur dioxide and suspended particulates. In the UK there were concerns that London would not meet the standard and studies were carried out using the emission inventory and air quality models to work out the most cost effective measures that could be introduced to ensure that the air quality standard would be met. In the event the levels fell of their own accord as gas replaced coal and oil and control measures did not have to be introduced. Nevertheless, this example shows the importance of emission inventories in that they provide basic information to help tackle air quality problems.

Airborne lead represents another success story. Figure 3 shows the results of lead monitoring at County Hall in central London from 1978 to 1989. There was a slow decline from 1978 to 1985, then a steep drop at the end of 1985 when the maximum amount of lead allowed in petrol was reduced from 0.4 g/l to 0.15 g/l, after which it levelled out for two years before falling again. The latest fall will be related in part to the introduction of unleaded petrol, which accounted for 30 per cent of sales in London at the end of 1989. The use of unleaded petrol did not really grow until the Government intervened and made the price lower than that of leaded petrol, by about 5 per cent.

The picture so far is one of improving air quality in London, but air quality problems remain. These are typical of most cities and include ozone; carbon monoxide; nitrogen dioxide; sulphur dioxide (short term peaks only); airborne particulates, particularly at the roadside; nuisance dust and odours. The latter two are mainly local problems due to particular sources, such as construction sites or local industry. Traffic, though, is now the most important pollution source in London, being responsible for some of the nuisance dust, and a large part of the ozone, carbon monoxide and nitrogen dioxide problems.

It was said earlier that London's sulphur dioxide problems have gone away. In many respects, this is true, apart from occasional short lived high levels which occur for only a few hours at a time when there is a moderate easterly wind blowing emissions from the power stations along the Thames Estuary across London. Levels then exceed the one-hour guideline set by WHO. This illustrates the importance of the WHO document on air quality guidelines, as it provides one-hour guidelines for most pollutants which had not been available previously. Without these guidelines the remaining sulphur dioxide problem in London would not have been apparent.

Turning now briefly to nitrogen dioxide. LSS operates a network of around 70 monitoring stations across London on behalf of London Boroughs, using the cheap and easy diffusion tube method. This allows estimates to be made of compliance with the UK air quality standard (based on the European Community Directive). Figure 4 summarises some of the findings of this survey. It shows concentrations, as estimated 98 percentiles, for sites across the whole of London plotted against distance from the kerb of the road. It also shows the Limit and Guide Values. There are two important features, firstly, the Limit is only likely to be exceeded within about 10 metres of the kerb. Secondly, background levels across London away from the immediate vicinity of the road, are high and generally above the Guide value. There is also evidence from LSS monitoring

at County Hall in central London that nitrogen oxides levels have risen during the 1980s (Figure 5).

This leads on to what can be done about the problem. From the beginning of 1993 all new cars coming onto the road in EC countries can be expected to have to meet stringent new emission standards that will require the fitting of catalytic converters. Nitrogen oxides emissions from petrol cars should drop significantly. But what effect will this have on nitrogen dioxide air quality? This question brings us back to the important role of emission inventories.

Warren Spring Laboratory, the UK Government's air pollution laboratory, has used the emission inventory LSS carried out in 1984 to model nitrogen dioxide concentrations in London. They have also projected to the year 2000, when most cars will be fitted with catalysts. The result is that for central London they predict only a five per cent decline in nitrogen dioxide levels. This would suggest that London's air quality problems are not about to go away. Part of the reason is the growth in traffic.

Finally, mention should be made of the importance of providing information on air quality to the public. If the public understands air quality problems then it should be easier to obtain their support for the control measures necessary to combat them. In London LSS started the "Air Watch" service at the beginning of the year (Figure 6). Each day the results from the four monitoring stations that LSS operates across London are published in the Evening Standard newspaper. It is a simplified pollution index and is based on comparing carbon monoxide (8-hour average), nitrogen dioxide, sulphur dioxide and ozone levels with the WHO guidelines. The safe level is taken to be the WHO guideline. A pollution forecast for the day ahead is also made.

In conclusion:

- you have to measure air pollution in order to know if you have a problem and to understand the extent of the problem.
- you have to measure over a long period of time to establish whether things are getting better or worse.
- you need to carry out regular emission inventories to identify the causes of the problems.
- you need to model air quality to predict future changes and identify the most cost effective options to improve conditions.
- and finally you need to keep the public informed in order to obtain their support for the necessary control measures.

Based on a paper presented to the International Conference and Summit of Major Cities "Urban Air Quality"; Athens, 5-8 September 1990.



Figure 1 Sulphur dioxide levels measured at County Hall in Central London, 1931-1985. The different lines refer to different measurement methods and slightly different locations.

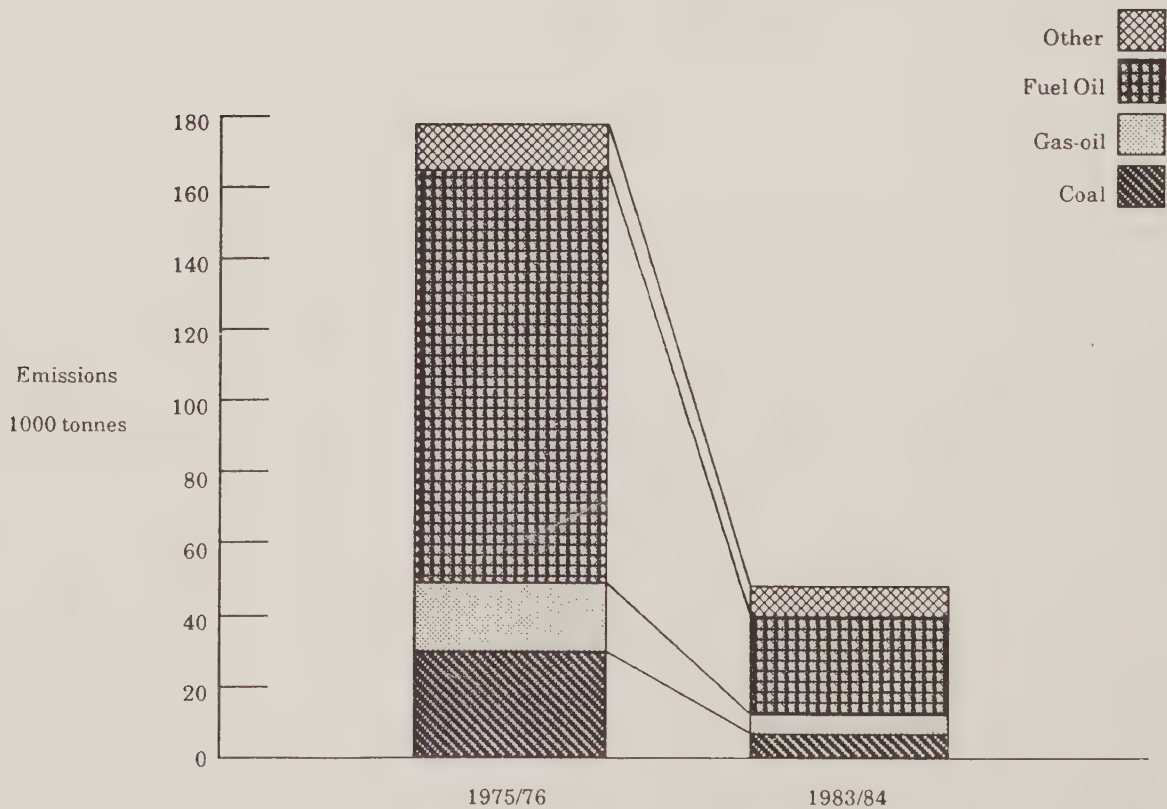


Figure 2 Estimated sulphur dioxide emissions for Greater London for different fuels, 1975/76 and 1983/84.

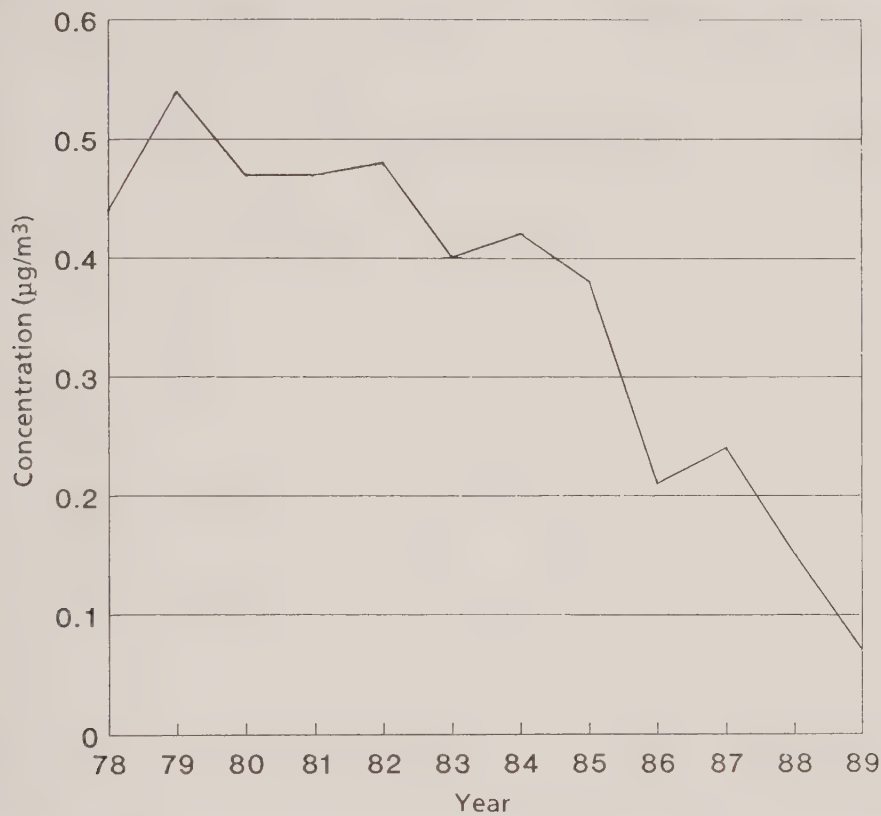


Figure 3 Airborne lead concentration measured at Central London background monitoring station, 1978-1989.

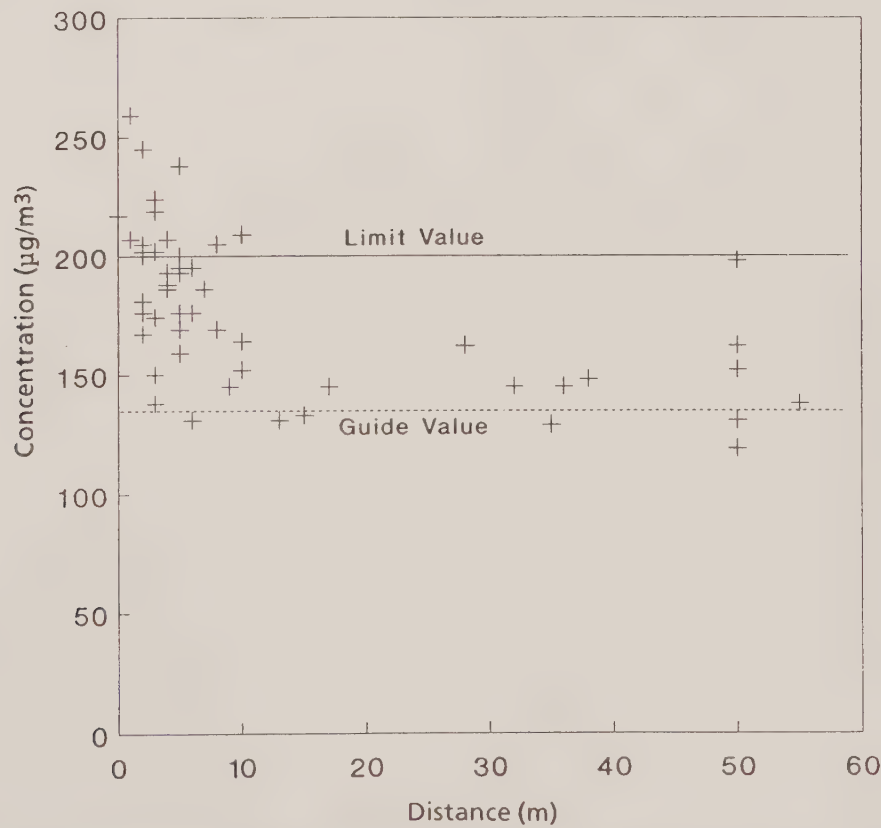


Figure 4 Nitrogen dioxide concentration as estimated 98 percentiles for sites in London at varying distance from the kerb. The 98 percentile is estimated as $2.4 \times$ annual mean. Also shown are the EC Directive Limit and Guide Values.

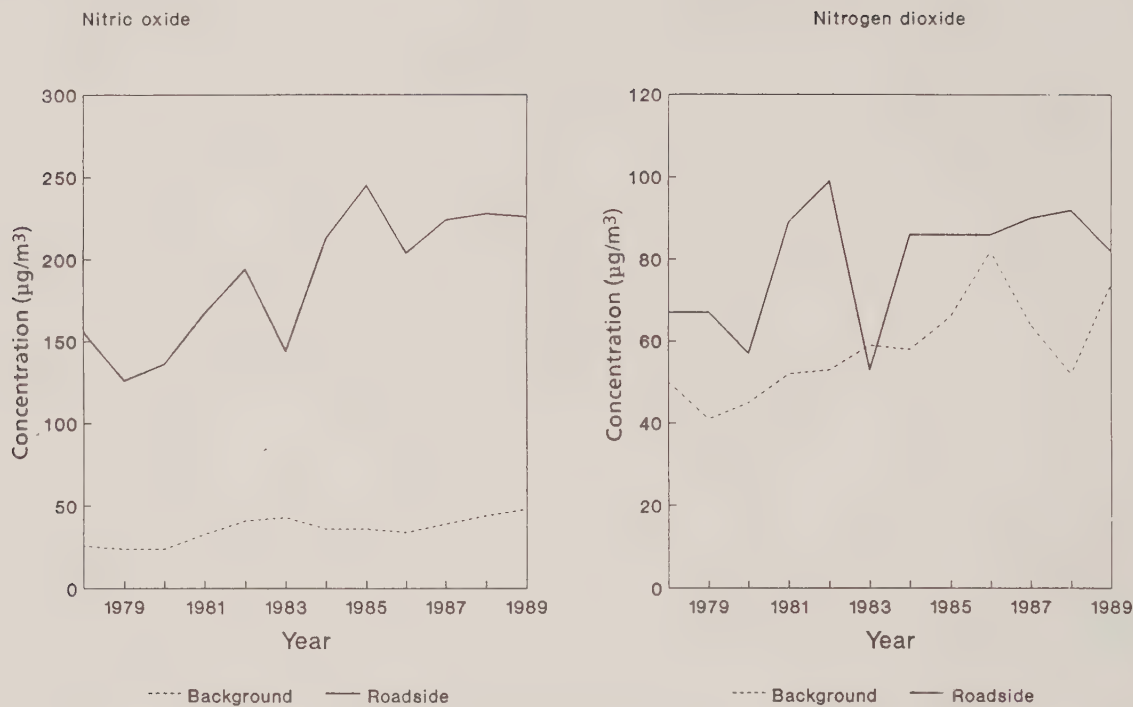


Figure 5 Annual mean nitric oxide and nitrogen dioxide concentrations at Central London background and roadside monitoring stations, 1978-1989.

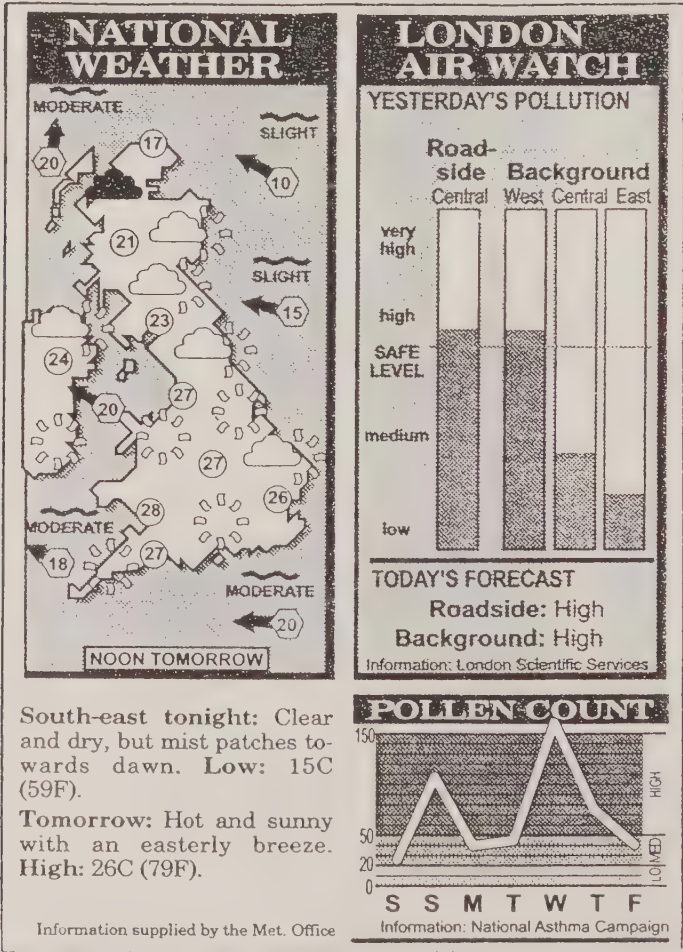


Figure 6 Air pollution levels in London as reported in the Evening Standard newspaper, 23 July 1990.

BRIEFING

ENVIRONMENTAL PROTECTION ACT 1990

The *Environmental Protection Act 1990* — the first major piece of environmental protection legislation in the UK since the *Control of Pollution Act 1974* — finally received Royal Assent on 1 November 1990. The Act, much of which is expected to be implemented during 1991, introduces some important changes to the control and regulation of pollution in Great Britain.

Part I of the Act introduces a new system of industrial pollution control. Integrated Pollution Control brings a cross media approach to controlling emissions whether to air, land or water for those processes with the potential to cause most pollution: these processes will be regulated by HM Inspectorate of Pollution (HM Industrial Pollution Inspectorate in Scotland). Local authority responsibilities are also considerably widened by being given powers to control air pollution from a range of less polluting processes. This Part of the Act is being introduced from 1 April 1991 in England and Wales, and a year later in Scotland.

Part II of the Act reforms waste disposal, handling and management in England, Wales and Scotland. There are new duties on producers of waste to ensure its safe disposal, stronger licensing powers for local authorities, continuing responsibilities for licensees to monitor closed waste disposal sites and more emphasis on recycling. In England and Wales, local authorities waste disposal functions are to be separated from their regulatory functions. Tougher controls on litter are introduced in Part IV of the Act. As yet no firm timetable has been announced for the implementation of Part II of the Act.

Part III of the Act updates and consolidates the law on statutory nuisance in England and Wales and comes into force on 1 January 1991. This part of the Act also clarifies the duties of local authorities in responding to complaints about statutory nuisance by requiring them “to take such steps as are reasonably practicable to investigate the complaint”. Other parts of the Act deal with amendment of the *Radioactive Substances Act 1960*; genetically modified organisms; straw and stubble burning, conservation; and new powers relating to hazardous chemicals.

Much of the Act will require secondary legislation in the form of Regulations before it can be fully implemented and already a number of draft regulations have been published for public consultation.

THE ENVIRONMENTAL PROTECTION (PRESCRIBED PROCESSES AND SUBSTANCES) REGULATIONS 1991

These relate to Part I of the Act and are due to come into force in England and Wales on 1 April 1991 and in Scotland a year later.

They detail the processes to be prescribed for Integrated Pollution Control and those for local authority air pollution control; a schedule to the regulations details the timetable within which existing Part A and Part B processes are to be brought within the new control regime in England and Wales. Separate regulations will be made specifying the timetable for Scotland. New and substantially modified Part A processes, and all large combustion plant, must apply for an authorisation not later than 30 April 1991.

Integrated Pollution Control (Part A Processes)

The timetable for bringing existing processes in England and Wales within the new control regime has been set as follows:

immediate: new and existing large combustion plant.

1 April-30 June 1992: gasification and associated processes; carbonisation and associated processes; combustion processes; petroleum processes.

1 December 1992-28 February 1993: incineration; waste recovery processes; treatment of waste chemicals; production of fuel from waste.

1 March-31 May 1993: cement and lime manufacture and associated processes; processes involving asbestos; other mineral fibres; glass manufacture and production; ceramic production.

1 June-31 August 1993: petrochemical processes, manufacture and use of organic chemicals; pesticide production; pharmaceutical production.

1 October-31 December 1993: acid processes, processes involving halogens; chemical fertiliser production; storage of chemicals in bulk.

1 March-31 May 1994: inorganic chemical processes.

1 November 1994-31 January 1995: iron and steel processes; smelting processes.

1 February-30 April 1995: non-ferrous metals.

1 November 1995-31 January 1996: paper and pulp manufacturing; di-isocyanate processes; tar and bitumen processes; processes involving uranium; coating processes; manufacture of dyestuffs, printing ink and coating materials; timber processes; treatment and processing of animal and vegetable matter.

Local Authority Air Pollution Control

Part B processes in England and Wales are to be brought within the new system in three batches, with relevant Process Guidance Notes (PG Notes) issued in advance:

From 1 April 1991-30 September applications can be accepted for: combustion processes; incineration processes; glass manufacture; ceramic manufacture; timber; maggot breeding; small waste oil burners.

1 October-31 March 1992, applications can be accepted for metallurgical processes, hot and cold blast cupolas; non-ferrous metal industries; mineral industries.

1 April-30 September 1992, applications can be accepted for di-isocyanates; solvents; coatings industries; offensive trades.

(Full details of the processes to be prescribed for Part A and Part B control, together with the timetable for bringing existing processes within the new control regime are given in the NSCA's 1991 *Pollution Handbook*, to be published in February.)

Prescribed Substances

Further schedules to the regulations list the substances to be prescribed for air, land and water releases; that for air applies to Part B processes scheduled for local authority air pollution control and all three lists apply to processes scheduled for Integrated Pollution Control. The substances concerned are:

Releases into the Air

- Oxides of sulphur and other sulphur compounds
- Oxides of nitrogen and other nitrogen compounds
- Oxides of carbon
- Organic compounds and partial oxidation products
- Metals, metalloids and their compounds
- Asbestos (suspended particulate matter and fibres), glass fibres and mineral fibres
- Halogens and their compounds
- Phosphorus and its compounds
- Particulate matter

Releases into Water

- | | |
|--------------------------------------|------------------------|
| Mercury and its compounds | 1, 2-Dichloroethane |
| Cadmium and its compounds | Trichlorobenzene |
| All isomers of hexachlorocyclohexane | Atrazine |
| All isomers of DDT | Simazine |
| Pentachlorophenol and its compounds | Tributyltin compounds |
| Hexachlorobenzene | Triphenyltin compounds |
| Hexachlorobutadiene | Trifluralin |
| Aldrin | Fenitrothion |
| Dieldrin | Azinphos-methyl |
| Endrin | Malathion |
| Polychlorinated Biphenyls | Endosulfan |
| Dichlorvos | |

Releases to Land

- Organic solvents
- Azides
- Halogens and their covalent compounds
- Metal carbonyls

Organo-metallic compounds

Oxidising agents

Polychlorinated dibenzofuran and any congener thereof

Polychlorinated dibenzo-p-dioxin and any congener thereof

Polyhalogenated biphenyls, terphenyls and naphthalenes

Phosphorus

Pesticides, that is to say, any chemical substance or preparation for destroying any organism harmful to plants or to wood or other plant products, any undesired plant or any harmful creature.

Alkali and alkaline earth metals and their oxides.

THE ENVIRONMENTAL PROTECTION (APPLICATIONS, APPEALS AND REGISTERS) REGULATIONS 1991

Again, these regulations are due to come into force in England and Wales in April 1991 and in Scotland a year later. They detail the procedure to be followed by all prescribed processes in applying for an authorisation, and the information to be included about the process. For Part A processes, an application must be made on a form to be available from HMIP; for Part B processes there is currently simply a requirement that the application should be in writing.

The regulations detail those to be consulted about the application and requirements for the applicant to publish details of the application in appropriate local newspapers. Copies of the application are to be available on a register for public inspection, as will the final authorisation and any conditions set. Normally HMIP will have four months from the date of receipt to consider an application for an IPC authorisation.

Local authorities will also normally have four months from the date of receipt to consider applications for Part B authorisations. However, under the (draft) *Environmental Protection (Authorisation of Process) (Local Control) Order 1991*, they will be given one year in which to decide applications for authorisations in relation to existing processes, and 18 months in the case of small waste oil burners under 0.4 MW.

A Guidance Note has been drafted by the Department of Environment for local authorities on the operation of the local authority air pollution control system; it provides guidance on the content of applications, procedural arrangements for handling applications and on the public registers which they are required to maintain. Where matters of commercial confidentiality or national security need to be resolved first, the timetable will be adjusted accordingly.

These regulations also set out the procedure for dealing with variations to authorisations, the appeals procedure and the information to be included on the public register.

CHARGING SCHEMES

The final version of the cost recovery schemes to be made under section 8 of the Act is due to be published soon, but is likely to follow the proposals published in 1990 (see *Clean Air*, Autumn 1990).

HMIP has, however, circulated for comment further clarification of how it defines “components” in the IPC charging schemes. The document says that the “purpose of the component concept is to provide a fair means of relating the size of the fee or charge for a particular IPC process to the amount of HMIP regulatory effort. Thus the fee or charge payable on a process will be the unit per-component tariff, multiplied by the number of components which the process contains”. HMIP has also revised the schedule of definitions of components.

IPC AND THE NATIONAL RIVERS AUTHORITY

HMIP and NRA have drawn up a Memorandum of Understanding in respect of responsibilities for those processes which involve discharges to controlled waters. The Memorandum sets out respective monitoring arrangements for authorisations involving both bodies; monitoring information will be shared to avoid duplication of effort. HMIP also confirm that operators whose processes are in this category will receive only one combined invoice covering both HMIP and the NRA charges, with HMIP reimbursing the NRA for its costs.

UPDATE

**NOISE REVIEW REPORT
PUBLISHED**

NSCA welcomed the report of the Department of Environment’s Noise Review Working Party, which was published in October. The recommendations of the Working Party, on which NSCA was represented, go considerably further than the Government’s White Paper (*This Common Inheritance*), published a month earlier.

Although some of the White Paper comments clearly reflect the findings of the Working Party, the noise report is firmer in tone and gives considerably more detail about how it would like noise control improved. Among its recommendations are:

- local authorities should be required to take “all reasonable steps” to investigate complaints about neigh-

bourhood noise. Councils should have officers available to deal with noise complaints at weekends and in the evening. The report notes that this could place an extra financial burden on authorities;

- streamlining the procedure for Noise Abatement Zones, to make them easier for local authorities to create and monitor;
- neighbourhood noisewatch schemes — at least one local authority has already expressed interest in running a pilot scheme;
- possible introduction of vehicle noise tests into MOT and roadside spotchecks;
- the proposal to extend sound insulation standards to building conversions, especially flats;

- better controls on sporting activities, perhaps with a general code of practice covering noise activities;
- planning applications to include an assessment of noise impact of developments (except housing);
- a new offence for owners or occupiers of premises who permit noise nuisance;
- rights to compensation for householders affected by increased noise due to traffic management schemes;
- local authorities empowered to control and monitor noise from airfields, take nuisance action against smaller aircraft and licence the use of private helicopter landing sites;
- car alarms should cut out after 30 seconds — if not, they should be subject to a fixed penalty notice. The current code of practice on burglar alarms should become mandatory, requiring notification of police and environmental health departments when alarms are fitted, and a 20-minute cutout period.

The report also makes a number of more technical recommendations including: a more extensive revision of BS4142; extension of S.60 COPA controls to mineral extraction sites, oil and gas sites and waste disposal sites; extension of S.105(1) of COPA to include the highway; reassessment of 68dB LA10 (18 hour) standard; sliding scale for eligibility for noise insulation work; requirement for developers to notify building control officer before sound insulation work takes place on buildings; buildings to be subject to post-construction sound insulation testing.

NSCA is pleased that the Government has brought noise matters to the

fore in recent months. The White Paper acknowledges the importance of noise as an environmental issue, and the Batho Report now points the way forward. The Working Party represented a wide range of noise expertise and its recommendations form a blueprint for a quieter Britain. We can only hope that the Government now fulfils its pledge to introduce new legislation at the earliest opportunity, and acknowledges the resources which will be needed to implement the recommendations.

AIR QUALITY BULLETINS

Following its commitment made in the White Paper on the Environment, the Government is making air quality information more widely available. Information will be provided by the Government's Warren Spring Laboratory from monitoring stations throughout the country and will be included in weather bulletins from the Meteorological Office for use by national television and the Press and via recorded telephone messages for members of the public (0839 500733).

NSCA had campaigned for such information to be made more widely available to the public, and while welcoming the Government's initiative is concerned that the definitions classifying air quality may be misleading.

Under the scheme, air quality will be designated as either very good/good/poor/very poor according to the presence of three indicator pollutants — sulphur dioxide and nitrogen dioxide in winter and ozone in summer. One disappointment is the slightly optimistic assessment of what constitutes good air quality. The criteria are shown below. In the very good category the air pollution levels represent typical background

levels. However the good section allows up to 100 ppb of ozone measured on an hourly basis. The World Health Organisation recommends a one hour guideline of 76-100 ppb for ozone — to describe ozone levels approaching 100 ppb as “good” surely requires the use of rose-tinted spectacles.

NSCA believes that the jump across the boundary between good and poor air quality is too sudden. We recommend the use of the same four-band criteria, but reclassified as good/moderate/poor/very poor. This would give a smoother qualitative gradation between the four categories and a more appropriate indication of environmental quality.

NSCA hopes that the Department of Environment will reassess their categories of air quality taking into account both the WHO Guidelines and practice elsewhere in Europe and in the USA.

In the meantime, however NSCA will be encouraging the media to carry reports of air quality routinely — both in the interests of those whose health may be affected, and as an exercise in increasing the public awareness of environmental quality. During the ozone episodes of last summer many journalists and news editors called for easier access to information about air pollution levels. Now it is available, let's hope they use it.

DOE air quality categories (ppb)

	NO ₂	SO ₂	O ₃
Very Good	<50	<60	<50
Good	51-100	61-125	51-100
Poor	101-300	126-500	101-200
Very Poor	>300	>500	>200

(For comparison, the US Environmental Protection Agency uses a five-band Pollution Standard Index with categories good/moderate/unhealthy/very unhealthy/hazardous. Germany has a three-band alarm index for smog alerts.)

REVISION OF BUILDING REGULATIONS 1985

The Government is consulting interested bodies with a view to upgrading the standards of sound insulation in Part E of the above Regulations and the supporting Approved Document.

In its response, NSCA welcomed the intention to extend the requirements to include material changes of use in a dwelling, particularly in relation to flat conversions. NSCA has been concerned

with the latter issue for a number of years and the new proposals meet our own recommendations. Whilst accepting that there will be practical difficulties in bringing some existing buildings up to standard, we have urged that emphasis is placed on standards for conversions approaching or matching newbuild provisions wherever possible.

In noting that the “deemed to satisfy” constructions offer valuable guidance on appropriate methods,

experience in the field suggests that in some cases, even where approved methods are apparently used, the final structure may fail to meet suitable acoustic standards. This may be due to a number of factors, but we recommend that the installation of sound insulation material should be considered as a critical stage of construction, and that builders should notify building inspectors who should be required to inspect such work. This should be supplemented with post-construction testing; this will require the development of agreed testing methods based on relatively simple measuring techniques.

ENVIRONMENTAL AGENCY FOR EASTERN EUROPE

A Regional Environment Centre for Central and Eastern Europe was established in September 1990. Based in Budapest, the Centre was proposed by US President Bush as part of a programme of environmental initiatives to help newly emerging democracies. The US has been working with Hungary, as well as the other founders, the European Economic Community and Austria, to establish the Centre.

The Centre — a non-governmental, non-profit making and independent agency — will serve as a source of information and assistance in resolving local, national, and transboundary environmental problems throughout Central and Eastern Europe. It aims to help individuals and organizations in the development of solutions to environmental problems and in the introduction of policies and procedures from improving environmental protection in the Region. Activities will focus on fostering capabilities and building skills to enhance the capacity of the people in

Central and Eastern Europe in addressing their environmental issues. The Centre will include the public sector and the general public as it strives to integrate environmental concerns and economic reform. The address of the Centre is Budapest III, Miklos ter 1.

RAC STUDY ON CAR POLLUTION

Results from an RAC research project published at the end of 1990 show that good maintenance could halve car pollution in the UK. The study showed that over half of vehicle pollution is caused by under 17 per cent of vehicles, with the worst one per cent of vehicles causing the same pollution as the best 40 per cent. Interestingly, researchers also found that the worst offenders were not necessarily the older vehicles, nor were they any particular makes or models. The problem appears to be directly related to maintenance and tuning.

The three day roadside study was carried out in November 1990 and involved a sample of nearly 7,000 vehicles. About 15 percent of the vehicles monitored would have failed the new MOT test emission standards now being introduced. However, as many newer vehicles (less than 3 years old) were significant polluters, MOT testing does not appear to provide the solution to the problem, although it will undoubtedly help. It is calculated that regular tuning and maintenance of all vehicles could halve emissions, without significant cost or difficulty.

EUROPEAN GREEN LABEL

Environment Commissioner, Carlo Ripa di Meana, announced at the end of November that plans for a Community wide "eco label" are now nearing com-

pletion. The label — a daisy surrounded by 12 stars — would be awarded to products which satisfied certain criteria relating to their environmental impact throughout their entire life cycle.

An international committee consisting of industry, consumers, trade unions, ecologists and the media will draw up the criteria to be used in assessing the various categories of products — initially paints, varnish, detergent, washing powder and chemical products used in the building industry. In due course the scheme will be extended to other categories.

Testing and evaluation of products will be a responsibility for the new European Environment Agency which has yet to be established owing to disagreement about where it should be situated.

DRAFT CODE ON NUCLEAR WASTE DISPOSAL

An International Atomic Energy Agency (IAEA) expert group has adopted a draft code which establishes principles guiding the international movement of radioactive waste.

The code was prompted by international concern over the possibility of radioactive waste being dumped in developing countries. While no case of radioactive waste dumping has come to light so far, the code is intended to provide preventive measures against any uncontrolled international movement and disposal of radioactive waste.

The code states that all stages of radioactive waste movements be undertaken in a manner consistent with international safety standards and take place only when authorized by all states involved, with prior notification and consent of the sending, receiving and

transit states. It also stipulates that all states should have the administrative and technical capacity, as well as the required regulatory structure, to fulfil their responsibilities under existing international safety standards. (*Development Forum, Sept/Oct 90*)

GREEN PETROL

Belgium, Germany and France are all proposing to — literally — dye their unleaded petrol green! This rather drastic action arises because some shady garages are buying unleaded petrol (which carries a lower tax), blending it with a bit of leaded petrol, selling the resulting mixture at the higher leaded petrol cost and doing the taxman out of about 3p per litre.

IEHO CHIEF EXECUTIVE

Terry Brunt took up his appointment as Chief Executive of the Institution of Environmental Health Officers at the beginning of 1991. Terry Brunt began his career in Birmingham's Public Health Department, and in 1987 he joined the National Home Improvement Council as head of the Agency Services Experiment; in 1989, he set up the National Urban Renewal Advice Service to promote the wider development of area agencies.

INDUSTRIAL

TYRES TO ENERGY

Wolverhampton Metropolitan BC granted planning permission in October to Elm Energy & Recycling (UK) Ltd's proposed whole tyres-to-energy facility, clearing the way for construction to begin in January 1991.

Elm Energy & Recycling (UK) Ltd will sell electricity produced at the facility to Midlands Electricity plc and the national grid under the Non-Fossil Fuel Programme's Renewal Energy Project. At a nominal capacity in excess of 22 Megawatts, it is the largest NFFO project, and represents over 20 per cent of the entire programme. The £36 million facility is expected to use 12 million scrap tyres per year and to be in operation by mid-1992.

Reader Enquiry Service No. 9027

AIR POLLUTION MONITORING SYSTEM

Philips Industrial Automation has launched a fully integrated air quality monitoring system for industrial and urban pollution monitoring. Designed for continuous remote monitoring, and housed in a rugged cabin, the system has already been extensively proven in Milan where it monitors pollution at 42 locations in the city centre to provide early warning of dangerous levels, allowing the authorities to re-route traffic to help control pollution.

The complete system can accurately monitor, on a remote automatic basis, a

wide range of pollutants including SO₂, NO, CO, ozone, hydrocarbons (methane etc), dust, H₂S etc. It can also measure meteorological parameters such as wind speed and direction, temperature, humidity and solar radiation. Its high accuracy of a few parts per million allows remote measurements of even very low concentrations of pollutants from distance sources, while its meteorological capability allows the pollution source and its effects to be more accurately tracked and predicted.

The systems are designed for continuous 24 hour unattended operation and the user can specify the exact combination of analytical instruments for any specific pollutants.

Reader Enquiry Service No. 9028

CGCT GENERATING STATION FOR NORTH WALES

Planning permission has been given to Deeside Power Development Company (DPDC) to construct and operate a 450 MW combined gas cycle turbine generating station at Clywd, N. Wales.

This consent follows a six month consultation period with various statutory authorities, county and district planning authorities and interested groups, both before and after the preparation of the environment statement. Although the proposed site is located in an industrial area, it was necessary to undertake extensive baseline noise, air and river water quality monitoring in the area, in order to establish the potential environmental impact of the proposed

project and to confirm its acceptability within guidelines. It was necessary to redesign aspects of the site infrastructure systems to ensure compliance with existing and future guidelines and to satisfy local concerns.

The use of a combined cycle power plant recovering the exhaust heat of the gas turbine together with the use of clean natural gas as fuel, ensures minimum impact on the environment. The plant will produce insignificant amounts of

sulphur dioxide and particulates and less than one quarter of the amount of nitrogen oxides discharged from other coal or oil fuel power stations. Carbon dioxide emissions will also be much lower than in traditional stations.

It is anticipated that construction will commence during the first half of 1991 and that the plant will start commercial operations in late 1993.

Reader Enquiry Service No. 9029

BOOKS AND REPORTS

ENVIRONMENTAL HEALTH LAW IN SCOTLAND

Francis McManus. Publisher: Gower, 1989. £32.50. ISBN 0 566 07036 7.

Although Scottish environmental law is in many areas the same as that for England and Wales, there are some important differences. This book details the legislation in Scotland relating to areas such as nuisance, noise, atmospheric pollution, control of waste on land and various public health acts. The actual legislation is set out, followed by an explanation and examples by way of case law. *Environmental Health Law in Scotland* will be of particular use to those “national” organisations based in England who should remember — but often forget — to make special mention of practice in Scotland.

YOU AND THE ENVIRONMENT

Edited by Katie McBratney. Publisher: Consumers' Association and Hodder and Stoughton, 1990. £8.95. ISBN 0-340-52797-8.

Consumers have not surprisingly become increasingly confused by manufacturers' claims about their green and environmentally friendly — or friendlier — products; their confusion is compounded when they then hear environmentalists pointing out that all products will have some adverse affect on the environment. *You and the Environment* looks at areas such as energy efficiency, transport, gardening and recycling, explaining why we need to think about changing our habits, and the pros and cons of doing so; there is advice for those individuals who want to do their bit for protecting rainforests and saving the ozone layer. *You and the Environment* suggests practical and realistic ways of helping to protect the environment that don't involve a radical, and for many, impossible change of life-style — the very thought of which puts a lot of people off even trying to be a little greener.

GREEN WARRIORS

Fred Pearce. Publisher: Bodley Head. 1991. £14.50. ISBN 0-370-31401-8.

That environmental issues are so high on both national and international political agendas is largely a tribute to the many campaigners — both those that work within relatively well organised and funded groups and those who work on their own sometimes at their own expense and often at risk of personal danger. This book is mainly about individuals some of whom will be familiar — like Max Nicholson who was behind the creation of the WWF, Teddy Goldsmith, founder and publisher of the *Ecologist*, and those that helped build FoE and Greenpeace into the successful organisations they are today.

However, while spreading the environmental message was not exactly easy for them, you cannot help but be astounded by the achievements of environmental campaigners in countries like Malaysia, Thailand and Brazil some of whom have died or been imprisoned for their beliefs. People like Chico Mendes murdered for his campaigning against deforestation in Brazil and Harrison Ngau, a member of the Kayan community, one of the largest tribal peoples who still live and farm in Sarawak. Ngau has campaigned extensively against deforestation in Malaysia and the resulting destruction of traditional ways of life. For his efforts. Ngau aroused the displeasure of the Malaysian Government and was placed in detention for sixty days.

In *Green Warriors*, Fred Pearce tells the stories of many of these campaigners, looking at their origins, philosophies and motivations, and he suggests how the environmental movement might fashion its agenda for the nineties and beyond. A fascinating and eminently readable book!

WATER LAW: A PRACTICAL GUIDE TO THE WATER ACT 1989

Masons, in association with the Centre for Environmental Law, University of Southampton. Publisher: Woodhead Faulkner, 1990. £30.00. ISBN 85941-670-4.

The *Water Act 1989* (covering England and Wales) radically reorganised the framework governing the management and supply of water as well as introducing tougher controls safeguarding water quality. A number of important regulations relating to the main sections of the *Water Act* have since been promulgated. This Guide is clearly written, explaining each section of the Act and its regulations and discusses possible legal implications. Reference is also made to European Community law on water quality and there is detailed information on the duties and responsibilities of the various regulatory authorities and the water companies.

CAPITAL KILLER: AIR POLLUTION FROM ROAD VEHICLES

Manda Adams. Publisher: London Boroughs Association, 1990. £5.00. ISBN 0951121979.

This report looks at the health and environmental aspects of pollution from London's traffic and argues that while technological measures can help, the real answer to a cleaner, healthier city lies in changes in transport policy and a move towards better public transport and planning to reduce dependence on the private motor car.

ENVIRONMENTAL PRACTICE IN LOCAL GOVERNMENT

Published by Association of County Councils, the Association of District Councils and the Association of Metropolitan Authorities. First edition, December 1990. Loose leaf ring file, £22.50. Available from the ADC, 26 Chapter Street, London SW1P 4ND.

Recognising that through their policy making and other activities, local authorities can affect global, national and local environments, the three national local authority associations representing England and Wales have cooperated in this manual which aims to raise environmental awareness and encourage environmental initiatives.

The manual is divided into various sections — such as environmental auditing, environmental education, energy conservation, waste management, waste reduction and recycling, planning and environmental protection. Each section starts with an introduction which sets the scene and outlines potential problem areas; this is followed by a few case studies showing how individual local authorities have chosen to tackle the subject. The manual does not, on the whole, relate subjects back to legislative controls and local authority practice in implementing legislation. In fact, local authorities' "environmental practice" with regard to those perennial favourites — smoke, noise and odour — hardly get a mention.

POLLUTION: CAUSES, EFFECTS AND CONTROL

Edited by R.M. Harrison. Publisher: The Royal Society of Chemistry. Second Edition, 1990. ISBN 0-85186-283-7.

The first edition of this book was published in 1983 and aimed to provide a basic textbook covering the more important concepts of pollution. This second edition has been considerably expanded to allow authors to cover their topics in more detail, although the aim is still essentially to give a broad overview. Among the many subject areas covered are: chemical pollution of the aquatic environment by priority pollutants and its control; the chemistry of metal pollutants in water; treatment of toxic wastes; water quality and health; important air pollutants and their chemical analysis; atmospherical dispersal of pollutants and the modelling of air pollution; and radioactivity in the environment.

THE TIMES GUIDE TO THE ENVIRONMENT

S. Simpson. Publisher: Times Books, 1990. £7.95. ISBN 0723003475.

The book outlines the way in which conservation and pollution control have become important factors in political and economic policy in an international and regional context. It reviews evidence of effects on all aspects of the environment in an international context and contains appendices of useful reference material and contacts.

ENVIRONMENTAL HYGIENE II

Ed. N.H. Seemayer, W. Hadnagy. Publisher: Springer-Verlag 1990. DM 128.00. ISBN 3540527354.

Proceedings of a workshop looking at procedures and approaches for detection of chemicals in the environment and the risks to human health.

COAL-USE TECHNOLOGY IN A CHANGING ENVIRONMENT

The advance continues

Walter C. Patterson. Publisher: Financial Times. 1990. £215.

An examination of the technologies based on fluidised bed combustion and gasification being pursued by the world's leading engineering firms and assessment of the results produced in the search for environmentally and commercially acceptable methods of burning coal.

TECHNOLOGICAL RESPONSES TO THE GREENHOUSE EFFECT

Ed. George Thurlow. Publisher: Elsevier, 1990. £45.00. ISBN 1851665439.

A Watt Committee report, divided into four sections covering emissions of greenhouse gases and their sources, major options available to the UK for reducing emissions, the views of the committee on the available options for the UK and of other countries consulted during research.

ENVIRONMENTAL CONSEQUENCES OF NUCLEAR WAR.

Scope 28. Vol I Physical and Atmospheric Effects, A.B. Pittock et al. Vol II Ecological and Agricultural Effects N.A. Harwell, T.C. Hutchinson, Publisher: John Wiley and Sons, 1989.

Two volumes which represent the first analysis by an international scientific group of the physical and biological effects that nuclear war would have. As there is no precedent for such an event conclusions drawn are not incontrovertible, however it is concluded that indirect effects — such as climatic perturbations and disruption of economic systems — could ultimately be of greater consequence than direct effects, and that such a war is the greatest environmental threat that we face.

RENEWABLE ENERGY SOURCES

Ed. M.A. Laughton. Publisher: Watt Committee on Energy. 1990. £5.00. ISBN 01851665005.

A report on the current status of technology and opportunities for the exploitation of renewable energy sources, covering the technical and economic aspects and relating these to the existing pattern of energy usage in the UK. It points to the expense to privatised industry and the need for long term investment in renewables.

THE GREENING OF URBAN TRANSPORT **Planning for walking and cycling in western cities**

Ed. R. Tolley. Publisher: Belhaven Press, 1990. £39.50. ISBN 1852930926.

A collection of essays by planners, engineers and consultants in the field of transport management, in three sections covering the principles, strategies and practice that should be taken on board to improve our urban environment by the minimisation of motor vehicle traffic.

THE PESTICIDE MANUAL

Ed. Charles R Worthing, Raymond J Hance. Publisher: British Crop Protection Council, 1990. £75.00. ISBN 0948404426.

A comprehensive guide to 670 chemical compounds and microbial agents used for controlling pests and protecting materials, indexed by chemical formula, chemical name and code numbers.

AIR POLLUTION AND FORESTS: Interaction Between Air Contaminants and Forest Ecosystems

William H. Smith. Publisher: Springer-Verlag 1990. DM 198. ISBN 3540970843.

An overview of the interactions between air pollutants and forest ecosystems, providing an analysis of relationships between forests and air pollutants.

THE GREENHOUSE EFFECT: FORMULATING A CONVENTION

William A. Nitze. Publisher: Royal Institute of International Affairs, 1990. £10.00. ISBN 0905031334.

Starting with the premise that an international convention on climate change has been recognised by governments as a necessity, this paper examines the targets that any such convention should set, and the likely responses of major countries to any such targets.

ENERGY POLICIES AND THE GREENHOUSE EFFECT, Vol 1, Policy Appraisal

Michael Grubb. Publisher: Royal Institute of International Affairs, 1990. £25.00. ISBN 1855211750.

A study examining the implications of the greenhouse effect for energy policies, which discusses the differences between countries which affect any international negotiations on limiting emissions and reviews the probable impact of such measures and the problems.

HAZARDS AND THE COMMUNICATION OF RISK

Ed. J. Handmer, Edmund Penning-Roswell. Publisher: Gower 1990. £47.50. ISBN 0566027844.

Proceedings of an International Workshop examining the communication of risk. Chapters cover the identification of risks, assessment of acceptability of risk and the communication of risk information to the communities affected.

HAZARDOUS WASTE MANAGEMENT New Regulation and Technology

Brian Price. Publisher: Financial Times, 1990. £5.00.

An overview of the current legislative pressures and technological trends in hazardous waste management covering industrial, hazardous and radioactive wastes, the definitions and properties of wastes, the disposal options and cost implications.

HOW GREEN IS BRITAIN?

The Government's Environmental Record

Friends of the Earth. Publisher: Hutchinson Radius 1990, £6.99. ISBN 0091745985.

With eight chapters devoted to individual environmental issues, this study sets out to establish the true extent of the government's commitment to the environment — claiming that in many instances Britain has been late to move in the right direction and is still the dirty man of Europe.

TRANSPORT POLICY AND THE ENVIRONMENT

Six case studies

Ed. J.P. Barde, K. Button. Publisher: Earthscan 1990, £9.95. ISBN 1853830755.

The book presents six case studies, by the Organisation for Economic Co-operation and Development, of the environmental effects of different transport policies — covering the USA, West Germany, France, The Netherlands, Greece and Italy, and these studies are related to the British position by the authors.

CLIMATE CHANGE AND WORLD AGRICULTURE

Martin Parry. Publisher: Earthscan, 1990. £9.95. ISBN 1853830658.

An analysis of the sensitivity of the world food system and the ways in which it will be affected if climate change occurs in line with current predictions. The book presents the evidence on which the Intergovernmental Panel on Climate Change (IPCC) assessment was based.

GLOBAL WARMING: The Greenpeace Report

Ed. Jeremy Leggett. Publisher: Oxford University Press 1990. £5.95. ISBN 0192861190.

A compilation of the work of scientists and energy analysts from around the world which assesses current data on global climate change and its implications. It outlines the action that is deemed necessary to avert a crisis and was commissioned as a shadow document to the findings of the Intergovernmental Panel on Climate Change (IPCC).

FUTURE EVENTS

12-13 and 25-26 FEBRUARY — HAZARDOUS WASTE MANAGEMENT AND LIABILITY

New liabilities and duties for those involved in the waste disposal industry as a result of the *Environmental Protection Act* and new EEC proposals: subjects to be looked at include costs to industry, acceptable methods of transporting dangerous substances, the role of the waste regulation authority and the relationship between COSHH and the EPA.

Venue: 12-13 Feb: The Café Royal, London.

25-26 Feb: Portland Thistle Hotel, Manchester.

Details: The Law and Business Forum. Tel: 071 499 8895.

14-15 FEBRUARY — CONTAMINATED LAND POLICY: REGULATION AND TECHNOLOGY

The *Environmental Protection Act* contains a number of provisions relevant to the development of contaminated land including a requirement for registers of past land use. This conference will provide an update on both technical and non-technical aspects of the subject with a particular emphasis on groundwater pollution and clean-up.

Venue: Royal Lancaster Hotel, London.

Details: Katie Lye or Louise Coote. IBC Technical Services Ltd. Tel: 071 236 4080.

25-27 FEBRUARY — THE ENVIRONMENTAL TECHNOLOGY SHOW

Exhibition of existing and developing environmental technologies covering waste treatment and recycling, alternative energy and power generation, instrumentation and metering and education and research. A series of seminars on environmental technology will run throughout the show.

Venue: Alexandra Palace, London.

Details: BFM Exhibitions Ltd. Tel: 071 724 0851.

26-27 MARCH — LOCAL AUTHORITY ENVIRONMENTAL POLICY: A FRAMEWORK FOR ACTION

Jointly sponsored by the Association of District Councils, the Association of Metropolitan Authorities and the Association of County Councils, this conference aims to help local authorities define and develop their environmental policies for the 1990s. The conference is being organised by the Robens Institute in association with the London Borough of Sutton.

Details: Michaela Merrett-Jones. Robens Institute. Tel: 0483 572823.

5-8 APRIL — INTEGRATED POLLUTION CONTROL: EUROPEAN PERSPECTIVES

Pollution control can only be effectively implemented if those responsible for policy development, implementation and enforcement view the subject in a comprehensive and transfrontier manner: this assertion forms the theme of the conference to be hosted by the newly formed Leeds School of the Environment. It will consider pollution control philosophies and practices and include speakers from the UK and Germany.

Venue: Leeds Polytechnic.

Details: Hilary Robson, Leeds School of the Environment. Tel: 0532 832600, ext.4020.

15-17 APRIL — ENGINEERING FOR PROFIT FROM WASTE

The aim of the conference is to highlight the contributions of the engineering profession in waste management and environmental protection. It will also put the spotlight on emerging trends in waste disposal and provide a forum for their evaluation.

Venue: Hilton International, Düsseldorf.

Details: Hazel Anderson, IMechE. Tel: 071 222 7899.

15-19 APRIL — INTERNATIONAL CONFERENCE ON ENVIRONMENTAL POLLUTION

The objective of the conference is to provide a continuing forum for the presentation and discussion of the state of the art in all scientific and policymaking aspects of environmental pollution and to explore the interface between science and environmental policymaking. Subject matters include air pollution, water pollution and soil pollution. The conference is sponsored by the European Centre for Pollution Research, the Government of Portugal, UNEP and UNESCO.

Venue: The Congress Centre, Lisbon, Portugal.

Details: ICEP Conference Centre, London. Tel: 071 976 1587.

16-17 APRIL — CLEARING THE AIR

Conference jointly organised by The British Library and Greenpeace to explore how science, technologies and policies will eliminate photochemical smog and acid rain.

Venue: Royal Lancaster Hotel, London.

Details: Status Meetings Ltd. Petersfield. Tel: 0730 66544.

16-17 APRIL — INDUSTRIAL AIR POLLUTION MONITORING GASEOUS AND PARTICULATE EMISSIONS

With increasing requirements to control emissions of air pollutants to the atmosphere there is a growing demand for accurate, fast and reliable instrumentation to monitor the concentrations of the various species. Measurements may be needed to establish compliance with legal limits, to test the efficiency of control equipment or to evaluate potential environmental impacts. The objective of this course is to familiarise all those concerned with industrial emissions with the currently available techniques. Gaseous and particulate emissions will be covered and both extractive sampling and in situ methods will be discussed. Lectures cover current and prospective emissions legislation, principles and practicalities of particle sampling; particle size analysis; smoke and dust

meters; gas sampling and sample conditioning; infra-red and UV/visible optical methods including cross-duct methods; electrochemical devices; methods for volatile organics.

Venue: University of Leeds.

Details: Mrs. D. Taylor, University of Leeds. Tel: 0532 332511.

18 APRIL — ENGINE EMISSIONS

This one-day course will explain the function of heated on-line gas analysis systems for CO₂, CO, O₂, UHC, NO_x and SO_x measurements from engines and a working system will be demonstrated with data logging onto a computer. Diesel particulate measurement systems will be included. Computer processing of gas analysis measurements to derive air/fuel ratios, combustion efficiency, temperature and various pollution parameters will be discussed.

Venue: University of Leeds.

Details: Mrs. D. Taylor, University of Leeds. Tel: 0532 332511.

THE ENVIRONMENTAL PROTECTION ACT AND INCINERATION PROCESSES

TRAINING WORKSHOP

TUESDAY 19th MARCH 1991

The Prescot Civic Hall, Eccleston St., Prescot, Merseyside

There is much uncertainty regarding the proposals for controlling incineration processes, but whatever people's views may be on such waste disposal practices, we must recognise that incineration is a secure method of waste disposal for the future. Officers should be trained appropriately in the principles of the different processes, methods of control and regulations to be applied.

The North West Division for the National Society of Clean Air and Environmental Protection is holding a one-day training workshop on the *Environmental Protection Act* and incineration processes. It is intended for officers and elected representatives of local authorities, industrialists, health authorities and other interested parties.

The aim of the *Morning Session* will be to provide a general background to the *Environmental Protection Act* and the development of regulations over incineration processes. The *Afternoon Session* will concentrate on the practical aspects of how various incineration processes are operated in order to destroy different forms of waste. Papers will be presented by those with "hands-on" experience/operator experience.

For further details and a registration form please write to Mr. R.N. Turner, Hon. Secretary, NSCA North West Division, Dept of Housing and Health, Knowsley Metropolitan Borough Council, 9 West St., Prescot, Merseyside L34 1LF.

NSCA LEAFLETS

A selection of explanatory leaflets on topical subjects
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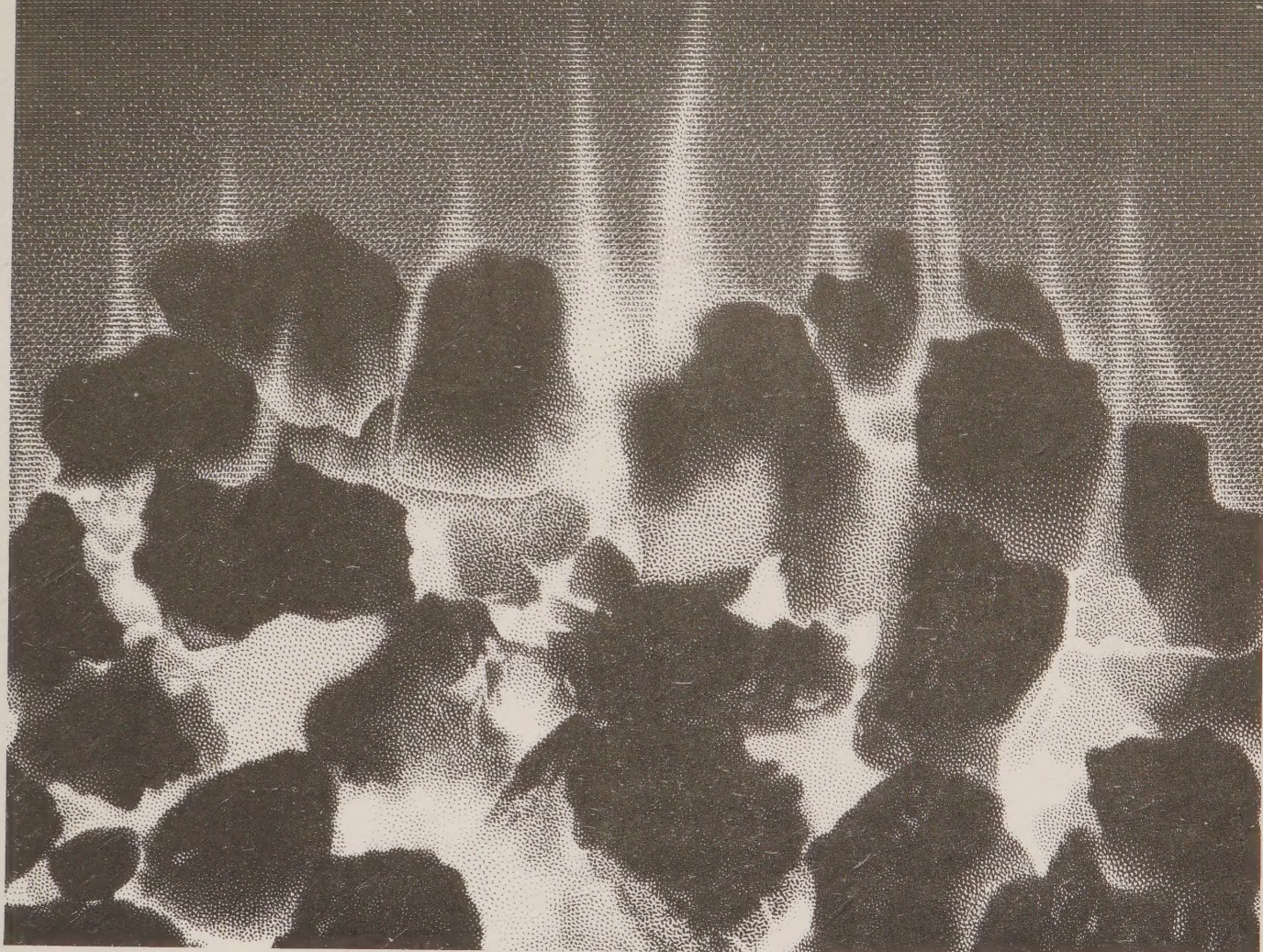
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